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LINDER (D. H.). **New species of Sphaeropsidales and Melanconiales.**—*Mycologia*, XXXV, 5, pp. 495–502, 1 fig., 1943.

Descriptions are given of five new species of Sphaeropsidales and Melanconiales, including *Dothiorella pinastri*, *Cryptosporium pinicola*, and *C. lunasporum*, all three on living blister rust cankers of *Pinus monticola* in Idaho. A key is presented illustrating the differences between the species of *C.* occurring on conifers in North America. This genus is difficult to define. In the early stages of development certain of the species might be placed in the Sphaeropsidales because of the formation of pycnidia, which, however, later rupture to form acervuli with free margins. Such acervuli are also characteristic of the Excipulaceae, yet the genus is placed in the Melanconiaceae. In this family are the genera *Hainesia*, *Gloeosporium*, and *Cryptosporium*, between which there appears to be no clear line of demarcation. *C. acicolum*, occurring as it does on leaves, might be placed in *Hainesia* or *Cercospora*. If this species is excluded, the essential characters of *Cryptosporium* appear to be the large, falcate conidia, the erumpent acervuli, which, as already mentioned, subsequently rupture, and the predominant occurrence on bark and twigs.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Elsinoe viticola.**—*Mycologia*, XXXV, 5, pp. 510–516, 1 fig., 1943.

Arnaud, in his survey of the Myriangiales, examined herbarium material of *Elsinoe viticola* on *Vitis coriacea* from Buitenzorg, Java (a species described by Raciborski in 1900), but his search for asci was unsuccessful.

In 1938 the authors undertook a critical study of Raciborski's exsiccatum of *E. viticola*. Sections of the most prominent fruiting bodies proved to belong to old pycnidia of a *Phyllosticta*, not necessarily connected genetically with the *Elsinoe*. Certain brown areas appeared to indicate where asci of the *Elsinoe* were produced. None were observed in these parts, but there was an abundance of hyphae typical of the genus, and therefore undoubtedly belonging to *E. viticola*. It remains a fact, therefore, that asci of this species have been seen, so far as is known, only by Raciborski.

The other species of *E.* known on Vitaceae is *E. ampelina*, the cause of vine anthracnose. The perfect stage of this species has been found only once, and there has been conjecture as to whether this fungus was not the same as *E. viticola* [*R.A.M.*, ix, p. 65; xiv, p. 616]. Lesions on *Vitis* produced by *E. ampelina* are, however, quite distinct from those on *Tetrastigma* (to which the type host of *E. viticola* is now referred), and as species of *Elsinoe* are often specific in their host relations, the previous reason for considering the vine anthracnose organism as identical, or possibly identical, with *E. viticola* no longer holds. *E. viticola* is considered to stand without synonymy, as originally described.

RISCHKOV [RYJKOFF] (V. L.). **The nature of ultra-viruses and their biological activity.**—*Phytopathology*, xxxiii, 10, pp. 950–954, 1943.

In the author's studies at the Institute of Microbiology, Academy of Sciences of

the U.S.S.R., Moscow, the nitrogen, phosphorus, and carbohydrate contents of healthy and mosaic-diseased tobacco plants were determined with the object of providing data regarding the nature of plant viruses. The results of an analysis of the nitrogen metabolism failed to show what is taken from the plant by the virus, but under conditions of phosphorus and nitrogen starvation diseased plants lost less protein than the healthy. The phosphorus content in diseased plants was no more, and often less, than that of the healthy. The amount of phosphorus in soluble proteins increased in the diseased plants, whilst that in the insoluble structural protein decreased, so that an expenditure of structural nucleoproteids appears to take place. Data are presented to show that the accumulation of virus is accompanied by a diminution of carbohydrates. From experiments on the physiological conditions necessary for the accumulation of virus in tobacco leaves it was found that there is no accumulation at 5° C. and that the accumulation is more rapid at 20° than at 15°.

WELLMAN (F. L.). **A new species of Fusarium causing vascular wilt of Tomato.**—*Phytopathology*, xxxiii, 10, pp. 956–958, 2 figs., 1943.

A technical description is given of a new species of *Fusarium* originating on a tomato showing symptoms indistinguishable from those caused by *F. bulbigenum* var. *lycopersici* in Indiana [*R.A.M.*, xx, p. 91], which also developed on Bonny Best and Marglobe inoculated with the new fungus. *F. retusum* n.sp. forms on potato dextrose agar a somewhat coarse, loose, fluffy, rapidly growing mat ranging in colour from white through livid pink, various shades of yellow, orange, tawny-olive, and garnet-brown to Morocco red; white, later greenish sclerotia developed sparsely, while cream-coloured sporodochia appeared consistently in a few monosporous isolates only. Infection hyphae were detected in re-isolation and histological studies exclusively in the xylem elements of diseased stems. The hyaline or faintly yellow- or red-tinted, septate, branched hyphae range from 2 to 7·5 μ in diameter; the hyaline, profusely branched sporophores bear colourless, straight to slightly curved, uni- to quinque-, mostly triseptate macroconidia, with a rounded, blunt apex and a distinct 'foot' on the proximal end, 26·8 by 4·3 μ; and hyaline, mostly unicellular, rarely uniseptate microconidia, generally oblong and umbonate at the base, 9·9 by 3·8 μ; the colourless, densely granular chlamydospores, of variable size and shape, occur principally in intercalary positions in the mycelium or in macroconidia. Morphologically the species is widely divergent from the slower growing *F. bulbigenum* var. *lycopersici* and possibly approaches *F. poae*, from which it differs in its blunt and rounded distal ends of the macrospores.

WILSON (J. D.). **Tomato varieties and the timing of spray schedules.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 221, pp. 75–82, 6 graphs, 1943.

A full account is given of an investigation in 1942 of the connexion between spray schedule timing and the control of fungal defoliation, ordinarily caused by early blight [*Alternaria solani*] and leaf spot [*Septoria lycopersici*: *R.A.M.*, xxii, p. 157], but during the very dry period covered by the tests at Wooster, Ohio, the latter disease was absent and the former developed abnormally late. Five varieties with different ripening dates were selected, namely, Huelsen (early), Stokesdale (medium-early), J.T.D. and Baltimore (medium), and Rutgers (late), and a fixed copper spray (COC-S) [copper oxychloride sulphate] applied in four schedules of five applications each, commencing on 20th June and 2nd, 14th, and 26th July, respectively.

The infection index of the several varieties was determined at weekly intervals from 2nd August to 20th September by Horsfall and Heuberger's method [ibid., xxi, p. 354]. Huelsen showed the highest incidence of disease throughout the season and Rutgers the lowest. The untreated plots of all varieties deteriorated

rapidly after 30th August. The average health of all the varieties was best in the plots sprayed from 2nd July onwards. The sprayed plots yielded an average of 10 per cent. more first-grade fruits than the controls, Rutgers being the heaviest producer of superior tomatoes, and Huelsen and J.T.D. the poorest. Maturity was appreciably retarded by spraying, especially in the plots to which the earliest schedule was applied. Early treatments also tended to increase the amount of blossom-end rot, particularly in the most susceptible J.T.D. variety, while the two latest schedules improved the condition of the plants in this respect.

CRANDALL (B. S.). **Bacterial infection and decay of the inner wood of winter-injured young London Plane trees.**—*Phytopathology*, xxxiii, 10, pp. 963–964, 1943.

In 1934 five-year-old London plane (*Platanus acerifolia*) trees on bottom land in a Maryland nursery were found to be infected by *Polystictus versicolor* and a Gram-negative, rod-shaped bacterium, 0·25 by 0·5 μ; the latter was experimentally shown to be pathogenic to the shoots of newly rooted cuttings. The trees had been injured by severe weather in March, 1932, and again in February, 1934, when frost cracks developing on the bark covering the water-soaked, necrotic inner wood served as channels of entry for the decay-producing organisms. Pruning wounds also acted as sites of ingress for *P. versicolor*, which rotted the inner ring tissues up to 6 in. in each direction from the cut.

WATERMAN (ALMA M.). **Diplodia pinea and Sphaeropsis malorum on soft Pines.**—*Phytopathology*, xxxiii, 9, pp. 828–831, 1943.

Examination of the type specimen of *Diplodia pinea* var. *corticola* Peck showed the spores to be smaller than those of *D. pinea* and within the range of *Sphaeropsis malorum* (*Physalospora obtusa*) to which species it was referred by Stevens [*R.A.M.*, xiii, p. 312]. A species resembling *S. malorum* (*P. obtusa*) has been found on dead areas on branches or trunks of *Pinus strobus* and certain old records of the fungus on *Pinus* are cited.

The results of field observations and inoculation experiments indicate, however, that neither *D. pinea* nor *S. malorum* is parasitic on the leaves and twigs of the new growth of young, vigorous white pines in New England [ibid., xvi, p. 75; xxii, p. 412], although both fungi may contribute to the unhealthy condition of soft pines weakened in the first instance by other factors. In a series of tests with *P. obtusa* on *Pinus nigra*, *P. sylvestris*, *P. strobus*, and *P. resinosa*, only one infection developed on a wounded twig of *P. sylvestris*. Improved cultural conditions and the prevention or protection of injuries should materially reduce the likelihood of invasion by the two organisms in question.

HUBERMAN (M. A.). **Sunscald of Eastern White Pine, Pinus strobus L.**—*Ecology*, xxiv, 4, pp. 456–471, 3 figs., 1 diag., 15 graphs, 1943.

Injury to the bark on the sun-exposed south-western sides of eastern white pines (*Pinus strobus*) standing on the north and east edges of openings made in forest stands is frequently observed throughout New England and elsewhere. It occurs on dark-coloured, smooth-barked trees in the form of dead strips of bark which often peel off, exposing the sapwood, or merely appear as depressed discoloured areas. The injury seriously degrades logs cut from the affected part, and provides entrance to fungi and insects. The injury measures on an average 6 to 29 ft. in length and 3·3 to 7·3 in. in width at its widest part, and affects most commonly trees with a diameter of 4 to 10 in., 31 to 51 years of age, in the intermediate crown class, and with a bark 3·7 to 7·5 mm. thick. Topography of the site does not materially influence the occurrence of the injury. Microscopic examination of the injured tissue indicated that the injury occurred after summer wood formation

had stopped and before spring wood formation had started, that is, between 1st October and 1st April. The highest summer temperature recorded (43° C.) was 14° below that supposed to be lethal to the tree, and was maintained for too short a time to have had any effect. Most frequently repeated thawing and freezing is encountered on the south side, and the most abrupt temperature drop is on the south-west side in winter. Sunscald in the north-east is considered to be a winter injury, and it is concluded both from the available literature and from evidence collected in this study that rapid freezing is a possible cause. Sunscald injury can be avoided by making the smallest possible openings consistent with sound silviculture; 'screen' trees should be left uncut on the southern and western borders of woodlots; extensive clear-cutting should not be used; and pruning of young trees should be done in two or more steps.

Arnold (W. P.). **Chemically treated wood in war and industry.**—*Chem. Engng News*, xxi, 14, pp. 1168–1171, 4 figs., 1943.

This is a useful survey of the different methods of chemical treatment of wood against various pathogenic agencies, including fungi, and of the standard preservatives in current use in the United States, with special emphasis on war-time conditions.

Cartwright (R. St.-G.) & Findlay (W. P. K.). **Timber decay.**—*Biol. Rev.*, xviii, 4, pp. 145–158, 1943.

A brief historical introduction to the subject of timber decay is followed by a critical survey and discussion of important contributions to the understanding of the problems involved under the headings of silvicultural considerations; diagnosis of cause of wood rots by pure cultural methods; general descriptive work; physiology of wood-rotting fungi; physical effects of decay in wood; chemical effects of decay in wood; effect of fungal decay on microscopic structure of wood; natural durability and resistance to decay of timbers; preservation of timber by chemical treatment; and field studies of timber decay and the application of the results of research to practice.

Schmidt (Herta). **Die Samenbeizung, ein Weg zur Leistungssteigerung im Gemüsebau.** [Seed disinfection, a means of increasing production in vegetable crops.]—*Kranke Pflanze*, xx, 3–4, pp. 19–22, 1943.

In connexion with war-time demands for increased vegetable production in Germany the writer discusses some important aspects of seed treatment, one of the foremost means towards this end. Only preparations officially sanctioned by the Biological Institute should be used, comprising at the moment abavit, ceresan, fusariol, and germisan, a liquid and dry form of each; formaldehyde is also permitted but can be dispensed with for horticultural purposes. Dusts are more suitable for some types of seed, such as flax, stocks, and snapdragon [*Antirrhinum majus*], which tend to become slimy on wetting, and liquid preparations for others, including lettuce, beans, peas, and *Lathyrus*. Tomato seeds are sensitive to chemical injury, and should either be dusted or immersed for brief periods (not exceeding 15 minutes) in a disinfectant solution.

Ling (L.) & Yang (Juhwa Y.). **Rape mosaic.**—*Nanking J.*, ix, pp. 293–304, 1 fig., [? 1940. Chinese, with English summary.]

In addition to information already summarized from another source [*R.A.M.*, xix, p. 514], it is stated in this paper that over 30 per cent. of the Chinese rape crop has been known to be destroyed by mosaic, while the survivors were stunted. The reduction in the seed yield ranged from 37 to 85·6 per cent. in the samples examined, while the crude oil content also declined substantially.

Björling (K.). **Några betningsförsök mot brunbakterios.** [Some disinfection tests against brown bacteriosis.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 5, pp. 7–11, 1943.

Dusting with uspulun (2 gm. per kg.) gave the best control of *Pseudomonas* [*Xanthomonas*] *campestris* on swedes in a series of experiments in Sweden, where the losses from this source may amount to 50 per cent. of the crop. In the latest test in 1942–3, for instance, involving 720 plants, the percentages of infection in the control, 0·1 per cent. formalin-treated, and uspulun-dusted lots were 74·2±3·42, 41·3±3·65, and 30·8±3·58, respectively, and the corresponding yields 19·1±0·95, 21·7±0·74, and 23·4±0·53, respectively.

Brickley (W. D.). **The efficiency of spray treatment as a remedy for boron deficiency in Sugar Beet and Swedes and for manganese deficiency in Oats.**—*J. Dep. Agric. Éire*, xl, 1, pp. 144–148, 1943.

Brown heart [*R.A.M.*, xx, p. 616; xxi, p. 426] having affected about 90 per cent. of the swedes on an alkaline light soil at Kilberry, South County Kildare, in 1940, a test was carried out in 1941 on another portion of the field, borax being applied (*a*) by broadcasting at the rate of 21 lb. per acre at sowing time, (*b*) at the side of the bulbs on 23rd July at the same rate, and (*c*) by spraying on the latter date with 7½ lb. borax per acre (i.e., 1 lb. per 10 gals. water), one plot remaining untreated. At harvest the bulbs showed, respectively, 22, 19, 17, and 66 per cent. brown heart.

In August, 1942, treatment of sugar beets severely affected by crown rot with borax applied to the soil at the rate of 20 lb. per acre, or as a spray at the rate of 5 lb. per acre (1 lb. per 20 gals. water) resulted in yields of 8 tons, 11 cwt., and 8 tons, 8 cwt. roots per acre, respectively, compared with 6 tons, 10 cwt. for the control areas.

When oats in areas (*a*) moderately, (*b*) very severely, affected by grey speck (manganese deficiency) [ibid., xxi, p. 522] were sprayed with manganese sulphate (1 per cent. solution, 10 lb. per acre), the treated plots showed improvement in six days and were comparatively healthy two weeks after treatment, the new growth produced after treatment being clean. Severe symptoms developed in the controls. The yields of grain and straw per perch were, in the severely diseased area, 1·7 and 7·5 lb. for the unsprayed plants, as against 8·75 and 19·25 lb. for the sprayed.

Carsner (E.) & Bennett (C. W.). **Name and classification of the curly-top virus.**—*Science*, N.S., xcviii, 2548, pp. 385–386, 1943.

The authors advance the view that the placing by Holmes of the curly-top virus in the family Chlorogenaceae and the genus *Chlorogenus* is erroneous, and that according to the symptoms induced by this virus in beets and other hosts it should be transferred to the family Rugaceae and the genus *Ruga*. The specific epithet, *eutetticola*, is also contested as being based on the assumption that the virus has only one vector, *Eutettix tenellus*, whereas it is now known that it is transmitted by *Agalliana ensigera* in Argentina; it is furthermore considered to be orthographically incorrect, the proper root for the first member being *eutettig-*. In view of the symptoms typical of the virus and because of its vector relationships it is proposed to adopt for it the name *Ruga verrucosans*, the specific epithet having the meaning of causing rough swellings.

Norris (D. O.) & Hutton (E. M.). **Pea mosaic with special reference to its effect on yield of seed.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 3, pp. 149–154, 1943.

In an experiment conducted at Canberra in 1942, the mosaic-resistant pea variety William Massey [*R.A.M.*, xix, p. 252] showed a greater capacity to emerge under cold and wet soil conditions than did the susceptible Greenfeast, their

average emergence being 72·6 and 50·7 per cent., respectively. Infection of Greenfeast peas with mosaic virus in the seedling stage reduced the yield by 17·4 per cent., while infection at any later stage had no significant effect on yield. Natural transmission of the virus appeared to be mainly due to aphids crawling from row to row and not to the flying forms. Spraying with nicotine and soft soap once a week against the vectors had no effect on the spread of mosaic. It is considered that in Australia, where red clover, which serves in New Zealand both as a perennial host for the virus and as a breeding-ground for the vectors, is of little importance; where aphid populations, probably owing to the general aridity of the climate, are not dense; and where, finally, pea crops are dispersed geographically, mosaic is not likely to be of commercial importance, at least not for the production of dried seed.

Ware (W. M.) & Glasscock (H. H.). **Cucumber virus 1 in ridge Cucumbers.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2971, p. 212, 1943.

In mid-July, 1943, outdoor cucumbers in an east Kent nursery were attacked by a virus identified by F. C. Bawden as that of cucumber mosaic, the varieties affected being Stockwood Ridge, King of the Ridge, and Telegraph. On inspection of the planting at the end of the month 147 out of a total of 1,030 plants had been removed and many others were diseased or dead. Sporadic infection also occurred on a second plantation of 5,000 plants covering two acres in another part of east Kent, while specimens were further received from a third nursery (in Sussex) in which 200 out of 800 plants had been killed. The virus is thought likely to have been involved in a prevalent wilting and death of ridge cucumbers in the same regions in 1942, while according to F. C. Bawden, similar symptoms have been observed in the Harpenden (Herts.) allotments.

Van Haltern (F.). **No more bad years for Watermelons. New wilt-resistant variety developed at Georgia A. E. S.**—Reprinted from *Sth. Seedsm., 1943*, January, 1 p., 3 figs., 1943.

A new variety of watermelon, resistant to wilt [*Fusarium bulbigenum* var. *niveum*: *R.A.M.*, xxii, p. 127], named Georgia Wilt-Resistant, has been developed at the Georgia Experiment Station from a cross between Cuban Queen and a wilt-resistant melon which was probably one of the earlier strains of Iowa Belle. In 1941 and 1942 the new variety produced good crops where other varieties were complete failures in 1940 because of wilt.

Hickman (C. J.). **Shanking : a new disease of Onion and Shallot.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2964, p. 140, 2 figs. (on pp. 141, 142), 1943.

Onions and shallots in the southern half of England appear to be widely affected by a new disease. The leaves turn yellow and shrivel up, and in young plants there is a softening of the basal tissues enclosed by the outer leaf sheath, while in older plants the bulb itself may be soft. The outer leaf bases sometimes have a dull, water-soaked appearance. The roots become similarly affected, but quickly dry up when exposed to the air. When a diseased plant is cut open longitudinally, the swollen bases of the youngest leaves surrounding the growing point are found to be discoloured and often much contracted. Sometimes there is no contraction, but the swollen leaf bases are uniformly soft and water-soaked. As a rule, there is a distinct demarcation line between the green, healthy tissues and the dull, buff-coloured, infected tissues below. Infected material invariably showed the presence of a species of *Phytophthora*. Bulb-softening and the absence of any external mycelium are characteristic features of the condition, which may aptly be termed shanking [cf. *R.A.M.*, xviii, p. 183].

Shanking was noted in autumn and spring-drilled onions, as well as among plants

raised in boxes. It was generally found occurring in scattered patches; in one case the loss of 1,400 out of 5,000 plants was reported, while in another planting of two acres there was an area of about $\frac{1}{5}$ acre in which an average of 21 per cent. of the plants had been destroyed. The disease is probably soil-borne, but does not appear to be correlated with any particular soil conditions. It is possible that losses may also occur in storage.

Stoller (B. B.). **Preparation of synthetic composts for Mushroom culture.**—*Plant Physiol.*, xviii, 3, pp. 397–414, 2 diags., 1943.

The synthetic composts for mushroom (*Agaricus* [*Psalliota*] *campestris*) culture [cf. *R.A.M.*, xxi, p. 182] described in this paper have been tested at the L. F. Lambert Research Laboratory, Coatesville, Pennsylvania, over a period of five years; the yields obtained being as good as, or better than, those from horse manure composts. The composition of the synthetic compost was based on the analyses of horse manure and mushroom, which are tabulated. As a result of extensive experimentation it was found that a satisfactory synthetic compost should contain about 13 lb. nitrogen, 4 lb. P_2O_5, and 10 lb. K_2O in 1 ton of fibrous material having 70 per cent. moisture, allowing for the quantities of these three constituents present in the fibrous material. The sources from which these constituents are derived are immaterial as long as the above-mentioned quantities and ratio are maintained. Spent licorice roots (from which the licorice has been extracted) and spent tannery nuts, bark, and leaves (from which tannin has been extracted) were more satisfactory than straw. Organic nitrogenous materials were preferable to inorganic ones and the best source of phosphorus was superphosphate. The importance of potash was demonstrated in one experiment in which its addition to composts prepared from spent licorice roots and brewers' grains gave almost double the yield from composts to which only nitrogen and phosphorus were added. In preparing the compost the nitrogenous material is spread or sprayed over the surface of the flattened heap of fibrous material and forked in about 1 ft. deep, all mineral ingredients are then mixed together, diluted with an equal quantity of loam, and spread evenly over the top of the heap, which is then mixed, watered as it is turned, and arranged into a pile with sufficient aeration. The length of the composting period was about four to five weeks for piles made with straw, eight days for small piles of licorice root composts (950 lb.), and 15 to 20 days for large ones (approximately 22,000 to 25,000 lb.). Large piles must have a ventilator in the centre to insure good aeration. The best yields were obtained by using 12 bush. compost for 24 sq. ft. bed surface, the compost heating to the high temperature of 140° F. necessary for killing pests.

Soaking nitrogenous materials in solutions of lignin or tannin extracts, designated as 'coprinating' agents, rendered the lengthy outdoor composting unnecessary and produced greater yields. The disadvantage of using these solutions lies in their acidifying nature, which makes composts more susceptible to the truffle disease, *Pseudobalsamia microspora* [ibid., xx, p. 512]. To make conditions unfavourable for this fungus and also in order to insure sufficient volatilization of ammonia, which is an important factor for killing the spores of *P. microspora*, the P_H of the compost should be adjusted to from 8 to 8·5. This value is highly favourable to *Coprinus* spp. (chiefly *C. fimetarius*), but these invaders are not as dangerous to the crop as *P. microspora*.

Treschow (C.). **Die Bedeutung der Wuchsstoffe für Psalliota hortensis.** [The significance of growth substances for *Psalliota hortensis*.]—*Naturwissenschaften*, xxxi, 16–18, p. 210, 1943.

At the Copenhagen Veterinary and Agricultural College the author studied the growth substance requirements of the cultivated mushroom, *Psalliota hortensis*

Lange [cf. preceding abstract], which was cultured on 50 c.c. of a synthetic solution containing glucose, asparagin, and the essential salts in conical flasks of 300 cm. capacity, each flask being inoculated with 0·25 sq. cm. mycelium from a glucose agar pure culture. Growth substances were supplied as follows: (1) 0·10 γ biotin; (2) 0·10 γ biotin + 100 γ d, l-sodium pantothenate + 100 γ nicotinic acid amide + 25 γ aneurin; (3) 0·5 c.c. beer wort, 12° Balling; (4) control. After 30 days the mycelial weights per 50 c.c. medium were (1) 16, (2) 68, (3) 63, and (4) 4 mg. Experiments with horse manure, to be fully described at a later date, showed the beneficial effects of this medium to be partially due to its growth substance content.

Lyon (A. V.) & Walters (D. V.). **Production of dried Grapes in Murray Valley irrigation settlements.**—*Bull. Coun. sci. industr. Res, Aust*, 143, 48 pp., 3 figs., 6 graphs, 1 map, 1941. [Photo-lithographed.]

The following items of phytopathological interest occur in this comprehensive account of the viticultural aspects of dried grape production in the Murray Valley, where the cultivation of vines for this purpose is carried on over an area of 57,000 acres between Woorinen, Victoria, and Mypolonga, South Australia. An endophytic fungus is invariably associated with the mature rootlets, and is parasitic at first; but the host rapidly reacts to its presence, and partial digestion of the hyphae takes place. Fungus diseases are readily combated and have been of minor importance in recent years. In seasons conducive to its development, however, black spot [*Elsinoe ampelina*] may cause the loss of an entire crop. The practice of removing all the diseased shoots is seldom necessary with up-to-date facilities for control. It was carried out, however, on a large scale in 1918, and the productivity of the canes noted in the following year. With early (October) removal one-half to three-quarters of a full crop was harvested, whereas the same operation in late November reduced the yield to the unprofitable level of 5 cwt. per acre.

Lennette (E. H.). **Recent advances in viruses. A brief survey of recent work on viruses and virus diseases.**—*Science*, N. S., xcviii, 2550, pp. 415–423, 1943.

In this paper presented before the Seminario de Biologia, held in Rio de Janeiro in July, 1943, under the auspices of the University of Brazil, the author deals mainly with viruses pathogenic to man and animals, and discusses, *inter alia*, their nature, chemistry, and antigenic structure.

Hoagland (C. L.). **The chemistry of viruses.**—*Ann. Rev. Biochem.*, xii, pp. 615–638, 1943.

This is a critical survey of recent studies on virus chemistry, summarized under the following headings: methods of isolation and criteria of purity of viruses; composition and structure; chemical derivatives of tobacco mosaic virus; molecular size and shape of purified viruses; electron microscopy of viruses; X-ray studies on viruses; antigenic structure of viruses; studies on virus metabolism; and effects of enzymes and reagents on purified viruses.

Moore (W. C.). **Diseases of crop plants. A ten years' review (1933–1942).**—*Bull. Minist. Agric., Lond.*, 126, 100 pp., 18 figs., 1 map, 1943.

This review of fungous, bacterial, and other diseases of crops for the years 1933 to 1942 gives a most precise and comprehensive picture of the plant disease situation in England and Wales. Among the many interesting records the following are worthy of special mention.

Black rust (*Puccinia graminis*) of wheat is stated to be most common in south-west Wales where barberry is abundant, but also to occur, though to a lesser degree, in most years elsewhere. In 1934 and 1935 the disease was not reported, while in 1937 it was above normal, and in 1940 appeared in August in epidemic

form in many parts of the country, being unusually severe in Yorkshire and Worcestershire. Late attacks by this rust are considered to be due to wind-blown uredospores rather than to the proximity of barberry bushes, this explanation being offered for the 1940 epidemic, as the prevailing winds in June of that year are known to have been favourable to the transport of uredospores from the Continent. This rust is occasionally found on *Mahonia* [*Berberis*] *aquifolium*, but neither this nor any garden species of *Berberis*, except *B. vulgaris*, is of economic significance in the spread of the disease. Yellow rust (*P. glumarum*) of wheat is often scarce in years following high summer temperatures, but is sometimes also scarce after cool summers, so that factors other than high temperature probably play a big part in the incidence of the disease.

Perithecia of *Gibberella zeae* [*R.A.M.*, xxii, p. 349] were found on seed of oats and barley in Cornwall, and on oat straw in Westmorland in 1940; the fungus was also observed at two places in Cumberland in 1941, and chiefly on oats but also on wheat and barley in widely scattered districts in mid-Wales in 1942, where a severe attack of ear blight had developed by harvest time and perithecia were present in profusion on the outer pales and grain. Black oat varieties remained comparatively free from attack by this fungus.

Relatively few records of grey leaf (manganese deficiency) of oats [ibid., xxii, p. 428] were received up to 1940, and these came mainly from Yorkshire, Northumberland, Lancashire, and Cardiganshire; but from 1940 to 1942 the disease was observed in other parts of the country as well, especially on newly-ploughed grassland on calcareous soils or where the soil had been heavily limed. In Yorkshire the disease is common on black soils containing much humus or lignin, which may overlie sand or heavy clay, or on fen and carr land where the soil reaction is neutral or alkaline. It caused much havoc there in 1941, partly, possibly, as a result of the liming campaign, partly because it was greatly aggravated by drought.

Of 100 barley seed samples representative of over 2,000 received at the Official Seed Testing Station at Cambridge from December, 1941 to January, 1942, only 9 were clean while 23 showed up to 20 per cent., 31 from 20 to 50 per cent., and 37 over 50 per cent. infection with the leaf stripe fungus, *Helminthosporium gramineum* [ibid., xxii, pp. 201, 300]. Leaf blotch of barley (*Rhynchosporium secalis*) [ibid., xxi, p. 154] has been troublesome for some 20 years in East Anglia and has lately been of more consequence than leaf stripe, which is no longer considered serious there.

The distinction made between the name 'spraing' [ibid., xviii, p. 201] applied to a potato tuber disease with arc-like lesions, and the term 'internal rust spot' [loc. cit.] reserved for one with a blotch type of symptom, is considered to be not quite beyond dispute, as both symptoms occur mainly in potatoes grown in dry, stony, sandy, or gravelly soils, usually deficient in organic matter, potash, and lime, and are not uncommonly found on the same tuber. The precise cause of both types is still unknown. Spraing is widely distributed and was reported every year, most often from Yorkshire and the north-west; it was very slight in 1936 and 1942, more prominent than usual in 1937 and 1938, and most prevalent in 1941. About 75 per cent. of a crop of Arran Pilot was severely affected in Cardiganshire in 1937, and 60 per cent. of a crop of Arran Banner in Berkshire in 1941. Internal rust spot is equally widely distributed; it was not reported in 1933 and 1942, or outside the Bristol Province in 1940, and was worst in 1938, particularly in Yorkshire. In 1935, 5 to 6 tons of Great Scot in Yorkshire proved unsaleable on account of it. Arran Consul is the safest variety to grow where these diseases are apt to occur badly, and on land not so prone to them King Edward may be grown profitably.

Spindling sprout of potatoes is not common, and was not reported except in 1936. There is no evidence that this disorder is of virus origin. In France, where it

has been known for over a century, it is believed to be a non-parasitic trouble apt to occur in dry regions or in other areas after abnormally dry summers; in the United States it is chiefly a trouble of southern-grown seed; and in Germany it was described as prominent in some districts in 1912 after an exceptionally dry summer of the previous year. Under such dry conditions the tubers remain still young, perhaps only half-grown, with their eyes only partially developed; when lifted they prematurely ripen off and commonly produce spindling sprouts. Similar symptoms can sometimes be induced if a break is made in the rest period during storage.

Symptoms suggestive of yellow dwarf [ibid., xxi, pp. 442, 443] appear to be fairly common in shallots and, to a lesser extent, in onions, but little attempt has yet been made to identify the trouble definitely or to distinguish it from mosaic due probably to cucumber mosaic virus.

Perithecia of *Leptosphaeria coniothyrium* were observed on young maiden apple trees in Cheshire in 1938. Infection appeared to have entered where the shoots had been pruned and to have spread downwards to soil-level.

Silver leaf (*Stereum purpureum*) [ibid., xxi, p. 459] of plum is still widely distributed and prevalent; more so in 1937 and from 1939 to 1941 than in the other years. The disease tends to be worse after a heavy cropping season, when branches are broken and the fungus can enter through the wounds thus made. A survey carried out in Essex in 1941 showed that silver leaf occurred most commonly in well-kept orchards that cropped heavily. High winds may also lead to abnormal breaking of branches. The fact is stressed that affected trees often recover without treatment and that they do not become a menace to neighbouring trees until the branches begin to die.

Browning and stem-break of flax (*Polyspora lini*) [ibid., xxii, p. 358] was first reported in 1941 from Lincolnshire and Nottinghamshire, but is known to have been present in the eastern counties at least a year or two before then. In 1942 it was very common in northern Pembrokeshire, causing from 1 to 90 per cent. infection (an average in 12 crops of 45 per cent.). The disease appreciably reduced the yield and the viability of the seed. Wilt (*Fusarium lini*) and 'pasmo' (*Phlyctaena linicola*) [*Sphaerella linorum*] have not yet been recorded in this country, but in 1942 an unidentified species of *Fusarium* was associated with yellowing and stunting or with wilting of flax seedlings in Warwickshire, Yorkshire, the east Midlands, and Norfolk [cf. ibid., xxiii, p. 17].

Reports of cucumber mosaic virus causing browning of lupins [ibid., xviii, p. 784] are stated to have increased since 1936, especially from the southern half of the country.

MEIER (K.). **Bericht der eidgenössischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für das Jahr 1940.** [Report of the Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture at Wädenswil for the year 1940.]—*Annu. agric. Suisse*, lvii, 5, pp. 419–461, 1943.

The following items of phytopathological interest, besides those already noticed from other sources, occur in this report. C. HADORN's experiments on the control of celery blight (*Septoria apii*) demonstrated the efficiency of copper oxychloride preparations, notably cuprenox, which increased the yield by 67 per cent. over that of the untreated plots.

Rose diseases, including true and downy mildews [*Sphaerotheca pannosa* var. *rosae* and *Peronospora sparsa*, respectively], black spot [*Diplocarpon rosae*], rust [*Phragmidium mucronatum*], and leaf spot, were found to be controllable by weekly treatments, from the inception of renewed growth until the end of June, of a combined sulphur-copper-derris dust, followed from July to the end of September by a monthly application of a copper spray, e.g., 0·3 per cent. copper

oxychloride (32 per cent.) + 0·05 per cent. of a spreader, supplemented during the intervening periods by dusting with sulphur-copper acetate at 10- to 14-day intervals.

Among the new plant-protectives analysed by C. Zäch during 1940 may be mentioned thiovit (Sandoz A.G., Basle), a sulphur 'wetter' particularly well adapted for combination with Bordeaux mixture, agrolit (later designated agrokupfer), a useful copper oxychloride spray supplied by Agro-Chemie Klingnau, with a guaranteed copper content of 32 per cent.; and carbylkupfer (Pflanzenschutzmittelfabrik E. Hungerbühler, Brugg) a basic copper sulphate spray for spring and summer use, with a guaranteed copper content of 46 per cent., the physical properties of which at a strength of 1·4 per cent. were adjudged to be satisfactory (also in combination with carbolineum); and etaldyn (Maag, Dielsdorf/Progil, Lyons), a pale yellow, clear liquid, soluble in water to give a practically neutral, dully opalescent solution with good wetting properties [see next abstract].

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1941 et 1942.** [Annual reports for 1941 and 1942 of the Federal Viticultural and Arboricultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, lvii, 5, pp. 462–498, 1943.

These reports [cf. *R.A.M.*, xxi, p. 279] contain, *inter alia*, the following items of phytopathological interest. In 1941 a series of experiments was carried out, in collaboration with other Stations in various parts of Switzerland, to determine the possibility of combining effective treatment of vines against downy mildew [*Plasmopara viticola*] with the stringent economy in copper dictated by the military situation [ibid., xxi, p. 497 *et passim*]. The best results were obtained with 1·5 or 2 per cent. Bordeaux mixture, with the addition of an adhesive to the lower concentration. On 2nd September the loss of grapes and leaves on the stocks treated with the 2 per cent. mixture and with the 1·5 per cent. plus cuprofix amounted to only 0·2 and 0·4 per cent., respectively. Used at a strength of 1 per cent. the Bordeaux mixture conferred a slightly lower, but still commercially sufficient degree of protection, the losses ranging from 1·8 to 2 per cent.; a reduction of the concentration to 0·5 per cent., however, definitely exceeded the limits of safety, permitting a 7 per cent. decrease in yield. A noteworthy observation was further made in connexion with the purity of the copper sulphate component and the efficacy of the mixture. Thus, with a purity of 99 per cent., the 1 per cent. Bordeaux allowed a loss from mildew of only 1 per cent., the corresponding reductions for the 93·5 and 89·9 per cent. purities being 3 and 3·2 per cent., respectively. Outside the experimental plots the Domaine de Pully vineyards were effectively treated with five applications of 1·5 per cent. Bordeaux mixture, the unsprayed controls being a total loss. A new copper product (Sandoz, Basle) gave excellent control, with only 0·15 per cent. reduction of yield. Three substitutes for copper included in the tests gave unsatisfactory results.

In 1941 grapes inoculated with the 'coître' fungus (*Coniothyrium diplodiella*) on 20th August and then sprayed with 0·5 per cent. cryptonol (oxyquinolin) + 0·1 per cent. cuprofix showed only 4 per cent. infection on 13th October, compared with 74 per cent. on the untreated controls. In 1942, when the disease was very severe following numerous hailstorms, causing an average reduction of 20 per cent., very promising results were obtained with pure copper sulphate (300 gm. per hl.) + 0·1 per cent. etaldyn [see preceding abstract], which reduced the loss to 4·8 per cent., while cryptonol, used on an extensive scale, was even more effective with a decrease of the damage to 1·3 per cent.

The ink disease [*Phytophthora cambivora*] appeared in some of the chestnut groves of Monte Ceneri, Ticino, for the first time. Experiments have been initiated

in situ with a view to preventing the spread of infection and the restoration of the less severely affected trees.

Satisfactory resistance to apple scab [*Venturia inaequalis*] was shown in 1941 by the Jonathan, Ontario, Reinette Ananas, Reinette de Champagne, Reinette de Chevroux, Reinette grise Parmentier, and Transparente blanche varieties. Protection against the majority of apple pathogens was secured by the following spray schedule: 26th February, 4 per cent. carbolineum; 22nd April, 2 per cent. lime-sulphur (22° Baumé)+200 gm. copper oxychloride; 23rd May, 1·5 per cent. lime-sulphur+0·5 per cent. lead arsenate; 3rd June, 1·5 per cent. lime-sulphur+50 gm. copper carbonate; 26th June, 1·5 per cent. lime-sulphur +1 per cent. lead arsenate; 15th July, 0·4 cupritox (on late varieties); 13th August and 5th September, 150 or 100 gm. copper carbonate on varieties susceptible to late scab.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1940–41*, Part I, pp. 119–135, 2 figs., 1 map, 1943.

This report on plant disease work in Iowa in 1940–1 [*R.A.M.*, xx, p. 343] contains the following items of special interest. In breeding studies with 85 strains of watermelons conducted by A. W. Welch and I. E. Melhus, one unnamed strain resistant to both wilt [*Fusarium bulbigenum* var. *niveum*: see above, p. 86] and anthracnose [*Colletotrichum lagenarium*] showed much promise, becoming infected with anthracnose about ten days later than the susceptible varieties and remaining alive and maturing melons two weeks after the susceptible varieties were dead. Seed of the new striped, wilt-resistant Dixie hybrid was released during the year. Preliminary investigations indicated that there is a definite succession of root parasites on watermelon plants; *Pythium*, *Fusarium*, and *Rhizoctonia* were isolated in the order named. *Pythium* and *Rhizoctonia* caused serious damage and appeared to influence infection by the wilt organism, but the exact nature of that relationship is not yet known. Blossom-end rot, caused probably by *P. acanthicum*, was very severe on the watermelon variety Hawkesbury, rendering in one field as much as 49 per cent. of the set fruit of that variety unmarketable. The disease was found only occasionally affecting other varieties. Inoculations with *P. acanthicum* were, however, unsuccessful with Hawkesbury melons that had normal blossom-end tissue, wounds or any dead areas that might develop around the floral scar being essential for infection. One collection of the parasite was capable of penetrating the pericarp of very young melons.

H. C. Murphy reports that races 1, 6, and 7 of crown rust of oats [*Puccinia coronata*] were the most widespread and prevalent in 1940. An epiphytotic of halo blight of oats (*Bacterium* [*Pseudomonas*] *coronafaciens*) was present throughout Iowa in 1940. Fortunately a large portion of the selections of hybrid origin in the nursery at Ames were resistant, particularly those with Bond as one parent. Isolations from field collections yielded 15 pathogenic cultures of *P. coronafaciens* and two of *Bact. striafaciens* (the cause of stripe blight). Of the 30 oats varieties included in 42 uniform rust nurseries grown in 27 States in 1940, 18 were of hybrid origin and resistant to either or both crown or stem rust [*P. graminis avenae*], all except one being also resistant to loose and covered smuts [*Ustilago avenae* and *U. kolleri*]. Of these varieties of hybrid origin 12 had Victoria as one parent and were resistant to both smuts and crown rust, four of them (Boone, Control, Tama, and Vicland) being also resistant to stem rust. The two Bond-hybrid selections (C.I. 3543 from a cross with Iogold, and C.I. 3483 from a cross with Morota) had an average coefficient of crown rust infection of 0·29 compared with 0·01 for Bond, ranking next to Bond itself among all the 30 varieties under observation, with the exception of one lapse on the part of C.I. 3483, which had a recorded coefficient of 20·0 in one nursery. Both hybrids are resistant to stem rust and to most races of both smuts.

In field tests conducted by I. E. Melhus sweet potato varieties Schumaker, Maryland Golden, and Priestly were found to be more resistant to stem rot [*F. batatatis* and *F. hyperoxysporum*] than were the Yellow Jersey, Nancy Hall, and Noltes. The most resistant among them, Schumaker, showed an 80 per cent. stand at digging time with 37 per cent. healthy plants; the most susceptible, Noltes, a 56 per cent. stand with 20 per cent. healthy plants. Dip treatments of slips against stem rot resulted in all cases in less growth and poorer stands during the first month than in the untreated controls: but at the end of the season the percentage of healthy plants following treatment with P.D. 7 and cuprocide was in Schumaker 58 and 65 per cent., respectively, as compared with 44 per cent. in the control, and in Noltes 46 and 39 per cent., respectively, as compared with 33 per cent. in the controls. A dip treatment with a mixture of aniline oil and mercuric chloride was in no case beneficial, and none of the treatments had any effect on the Nancy Hall variety. Vine cuttings of sweet potatoes were no more resistant to stem rot than slips, but when planted in steamed soil for two weeks prior to transplanting into the field, they showed 100 per cent. healthy plants, even when after being thus started in steamed soil they were dipped in a spore suspension of the stem-rot organisms and then planted in artificially infected soil. There is evidence from a limited number of experiments, supported by field observations, that the organisms do not enter the plant through the roots. Where diseased runners were found, the point of entry was a definite wound.

G. Semeniuk and I. E. Melhus state that the yellow dwarf virus disease of onions has been held in check by the control measures applied, and is now infrequent in the State. During the 1940 season neck rot [*Botrytis allii*], which had been of minor importance in previous years, became epiphytotic in the peat land onion districts causing losses of 50 per cent. in about 10 per cent. of the fields.

I. E. Melhus, J. N. Martin, and H. C. Murphy report that an examination of the root systems of apparently healthy lucerne seedlings grown on slightly acid soil revealed slight to severe discoloration of the primary and secondary roots. Isolations from these diseased roots yielded in most cases *Fusarium* spp., and only occasionally, from very young seedlings, *Pythium de Baryanum*. In greenhouse experiments soil infected with the *Fusarium* isolates yielded 100 per cent. healthy seedlings, whereas soil infected with those of *P. de Baryanum* yielded 100 per cent. diseased seedlings. No appreciable difference was observed in seedling stands of lucerne on limed or unlimed soil.

In fungicide tests conducted by C. S. Reddy, E. L. Waldee, I. E. Melhus, and R. H. Porter, two lots of potato seed, one very scabby and the other free from scab but showing *Rhizoctonia* [*Corticium*] *solani* sclerotia, were treated with semesan bel, mercurnol, cinnex-20, acidulated mercuric chloride, yellow oxide of mercury, hot formaldehyde, and an ethyl mercury chloride instant dip. All treatments caused either an increase in yields or at least no injury to scabby potatoes, but in the case of scab-free seed no yield increases were obtained and yellow oxide of mercury and cinnex-20 caused marked injury, resulting in a reduction of about 30 per cent. in the average yield. With both lots of seed the ethyl mercury chloride instant-dip treatment appeared to give as much protection from seed-borne pathogens as did hot formaldehyde.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 10, pp. 463–466, 6 figs., 1943.

Citrus psorosis [*R.A.M.*, xxii, pp. 62, 63] was first observed in New South Wales about 15 years ago, but so far it has not been of much economic importance. The light-coloured flecks found in California near the smallest veins of young leaves are not present locally. If the disease appears in a few trees in a block, the others should be inspected at regular intervals for early symptoms. If these are found,

the infected tissue should be removed and the wound disinfected. Trees in which the disease has progressed too far for treatment to be of any use should be retained as long as they continue to produce valuable crops, as they may do for years. Budwood should never be taken from affected trees, or from trees known to have come from the same source as infected trees.

In 1942 much wastage occurred in early dug potatoes, some of it being due to rotting by *Fusarium* spp. and *Pythium* spp. following on mechanical injury. Injured and diseased tubers should not be bagged with healthy ones before storage.

BAKER (R. E. D.) & MCKEE (R. K.). **Witches' broom disease investigations. VI. The infection of flower cushions and pods of Cacao by Marasmius perniciosus Stahel.**—*Trop. Agriculture, Trin.*, xx, 10, pp. 188–194, 12 figs., 1943.

In further studies on cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxiii, p. 9] in Trinidad, 262 cushions were inoculated, of which 60 became infected. These ranged from those bearing minute flower buds to those with grown flowers, symptoms generally appearing in three to five weeks. All the types of infected cushion found in the field were reproduced. Twenty-six cushions developed both infected vegetative shoots and abnormal flowers, two produced shoots only, and 32 formed only infected flowers. On the experimentally infected cushions two indirectly infected pods were formed, which grew to a length of a few centimetres and then rapidly turned brown; neither had developing ovules.

Of 594 cherelles inoculated, 102 became infected, though in one experiment 62 per cent. of the inoculations were successful. Cherelles up to 6 cm. long were infected, and the evidence indicated that all cherelles shorter than this are equally susceptible. The period that elapsed between inoculation and the first appearance of the symptoms ranged from three weeks to four months. Successful inoculation of cherelles under 3 cm. long generally resulted in the appearance of symptoms in four to six weeks. Larger cherelles, when inoculated, seldom develop distortion, and show symptoms only after the pod has begun to ripen. Small cherelles are sometimes infected without resultant distortion. A number of systemically infected pods developed from small infected cherelles about 1 cm. long when inoculated, and in these necrosis often did not occur until three months after infection.

Damage to the pod depended on its size when infected. A small infected cherelle generally fails to reach maturity, while cherelles infected when 4 cm. in length or more may ripen with some of the beans undamaged, though even in this case all the beans may be killed, particularly if the pod is not picked directly it ripens. In no case was infection restricted to the shell.

GREANEY (F. J.) & WALLACE (H. A. H.). **New and standard seed treatments in the control of certain seed-borne diseases of Wheat, Oats, and Barley.**—*Phytopathology*, xxxiii, 11, pp. 1064–1070, 1943.

Field experiments were conducted at several Canadian stations in 1942 to determine the relative value of certain standard and new fungicides for the control of the seed-borne pathogens, *Ustilago avenae*, *U. levis* [*U. kolleri*], and *Helminthosporium avenae* on oats, *H. sativum* causing seedling blight of wheat and barley, and *U. hordei* on barley. All the seed used in the tests had contracted heavy spontaneous infection in the previous season.

Ceresan, leytosan (both at the rate of ½ oz. per bush.), and ceresan dip (1 in 800, three minutes) gave excellent control of all the diseases, while formalin dip (1 in 320, three minutes) was effective against the smuts, but failed to eliminate *H. sativum* on barley or *H. avenae* on oats. Spergon, thiosan, and three unnamed dusts were unsatisfactory for the purpose in view.

Pugsley (A. T.) & Phipps (I. F.). **The combination of stem rust resistant genes from the wheats Eureka and Warigo.** *J. Aust. Inst. agric. Sci.*, ix, 3, pp. 130–132, 1943.

Under field conditions at the Waite Institute, South Australia, the Eureka wheat variety has always been resistant to *Puccinia graminis tritici*, but a disturbing outbreak on this variety in 1942 was reported in New South Wales by S. L. Macindoe in a private communication indicating that no single gene or genes from one variety will provide complete resistance. Combination of genes from varieties each carrying resistant genes will probably confer greater resistance. In tests with seedlings at low temperatures and using race 34 of the fungus the authors found a single gene difference in crosses between Eureka (resistant) × Dundee (susceptible) and Eureka (resistant) × White Federation 38 (susceptible). Field trials at the Waite Institute, where race 34 of the fungus predominates, failed to give any indication of the number of genes determining the resistance of Warigo. Modifying factors appear to be present, for in crosses between Warigo and susceptible varieties the F_1 is intermediate in its reaction to rust, and the F_2 and F_3 families segregate in a complex manner without a clear-cut segregation.

At 60° F., Eureka seedlings are resistant, and Warigo susceptible, to race 34. In 1942 and 1943 evidence was obtained from an F_2 of this cross that the low-temperature resistance of Eureka seedlings to this race depends on the presence of a single dominant gene. This was confirmed in tests with F_3 families. In field tests in 1941 F_2 and F_3 rows of (Eureka × Warigo) were subjected to a severe natural epidemic of race 34. Both parents were strongly resistant, but susceptible segregates appeared in both the F_2 and F_3 families. The field results, in contrast to the seedling tests with this material, indicated that in the cross (Eureka × Warigo) two independently inherited dominant genes for resistance operate. The progenies of susceptible field segregates were susceptible in the field and as seedlings in the glasshouse. Of the progeny from the field resistant segregates, some were homozygous resistant and others segregated when tested as seedlings. This behaviour provides a short-cut method for isolating the desired double dominant combination of genes.

Adopting a method suggested by Macindoe (unpublished thesis, University of Minnesota, 1941), the authors combined the physiologic resistance of Eureka with the mature-plant resistance of Warigo. Remnant seed of the more promising F_3 rows of (Eureka × Warigo), which were also homozygous resistant in the field in 1941, was available for testing as seedlings in the glasshouse in 1942. The F_3 families segregating with resistant and susceptible seedlings were selected. These, while heterozygous in the seedling stage to race 34, are homozygous resistant at maturity, the homozygosity being that of the mature-plant resistance genes. To obtain homozygosity of the physiologic resistance genes also, resistant seedlings were selected and their F_4 progenies tested in the seedling stage in 1943. A family (6543) homozygous for the physiologic resistance genes was obtained, which had the mature-plant resistance of Warigo and the physiologic resistance of Eureka.

Watson (I. A.). **Inheritance studies with Kenya varieties of Triticum vulgare Vill.** *Proc. Linn. Soc. N.S.W.*, lxviii, 3–4, pp. 72–90, 1 pl., 1943.

The valuable resistance to many races of stem rust (*Puccinia graminis tritici*) of two wheat varieties, Kenya 744 and Kenya 745 [*R.A.M.*, xx, p. 522], was found to be controlled mainly by a single major factor in each variety. Seedling and adult plant resistances to the disease were highly correlated, but the factors governing the two forms were not allelic in the two varieties. Kenya 745 has a single major factor, K_1, for resistance to races 1, 11, 14 (one culture), 15 (two cultures), 17, 21, 34, 36, 38 (one culture), 47, 49, 56, 69, 80, 97, 117, and 147, but

two factors, K_1, and K_2, unequal in their effects, appear to operate against races 14, 19, 38, and 59, the more efficient being the former, which confers resistance to races in the larger group. F_3 lines selected for resistance to any race in the first group will therefore be automatically resistant both to others in the same group and to those of the second. However, the converse does not necessarily apply, i.e., lines selected for resistance to the second group of races will not be invariably resistant to those of the first. Races 14 and 38 contained biotypes which gave reactions on the differential varieties typical of the race concerned. Two such biotypes could be distinguished in each race, tests on F_3 lines indicating that Kenya 745 had one factor for resistance to one biotype, and two factors for resistance to another of the same race.

Kenya 744 was also resistant to both races of powdery mildew (*Erysiphe graminis tritici*) present at the Minnesota Agricultural Experiment Station, where most of the work herein described was carried out.

Watson (I. A.) & Baker (E. P.). **Linkage of resistance to Erysiphe graminis tritici and Puccinia triticina in certain varieties of Triticum vulgare.**—*Proc. Linn. Soc. N.S.W.*, lxviii, 3–4, pp. 150–152, 1943.

The Thew and Kenya 744 wheat varieties are resistant to race 1 of *Erysiphe graminis tritici* and race 95 of *Puccinia triticina* [*R.A.M.*, x, p. 367 and preceding abstract]. In each variety resistance to both diseases appears to be controlled by the identical gene or by two very closely linked genes. The Kenya gene is allelic to that in Thew.

Atwood (H.) & Thomas (R. C.). **Eradication of three and a half million Barberry bushes protects Ohio grain from stem rust.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxviii, 224, pp. 193–197, 2 figs., 1 map, 1943.

In this popular note on stem rust of cereals [*Puccinia graminis*] in the United States and its control the writers state that the average annual loss due to the disease in Ohio alone was reduced from 7,500,000 bush. during the period 1916 to 1927 to 4,000,000 from 1928 to 1939, primarily through the eradication of the common barberry bushes serving as the alternate host of the pathogen. Since 1918, 3,262,000 bushes have been destroyed on 17,000 properties, and an intensive survey has been conducted over an area of more than 30,900 sq. miles, or about three-quarters of the State, every county of which has been found to contain barberries. Periodical reinspections are essential as long as there is any risk of renewed growth of the shrubs on the cleared areas: in 80 of the 88 counties bushes were found to have escaped from cultivation and produced seed for years before their destruction. Over 100 cases are on record in 42 Ohio counties in which local epidemics could be traced directly to the presence of barberries, in some cases at a distance of four or five miles from the crops.

The cultivation of rust-resistant varieties is the best method of combating epidemics of the disease conveyed by wind-blown spores from the south (Texas and northern Mexico), such as occurred in the Mississippi Valley in 1935, 1937, and (in a less severe form) in 1938 [cf. *R.A.M.*, xxiii, p. 59].

Machacek (J. E.). **An estimate of loss in Manitoba from common root rot in Wheat.**—*Sci. Agric.*, xxiv, 2, pp. 70–77, 1943.

The following procedure was adopted for the estimation of losses in Manitoba from common root rot in wheat (caused chiefly by *Helminthosporium sativum* and *Fusarium culmorum*) [*R.A.M.*, xxii, p. 426]. The entire wheat-growing area was divided into soil zones, and these in turn into sampling locations about equal

distances from one another. Altogether 60 wheat fields were thus selected, from each of which ten samples of plants were taken at maturing time from points separated by 50-pace intervals from each other. The ten samples were tied in one bundle and marked with the sampling location number. Later all bundles were opened in the laboratory, the plants within each classified into groups according to the severity of root rot in them, the plants and the spikes in each group counted, and, after the groups of plants from each bundle had been threshed separately, the average weight of grain per plant and per spike was computed for each group. In calculating the loss in yield for each collection from a field, use was made of the following formula: percentage loss in yield $= 100 - \left(\frac{W}{W_1 \times N} \times 100\right)$, where W is the total weight of grain from a collection, W_1 the average weight of grain from individual healthy plants, and N the total number of plants in a collection.

The tabulated data for the three years, 1939 to 1941, indicate a considerable variation in the percentage of diseased plants between soil zones or even possibly a greater one between different years. The percentage reduction in yield was not very closely related to the percentage of diseased plants in any one year, but there was relatively close agreement in this respect when the data for the whole three-year period or for all the zones were averaged. The average percentage of diseased plants and average reduction in yield for the three years was 38·3 and 12·1 per cent., respectively. An average for the three years showed that a slight attack by common root rot reduced the yield per plant by 25·7 per cent., a moderate one by 37·5, and a severe one by 53·3 per cent. About two-thirds of the total percentage of diseased plants in any one year or area showed slight root rot, and consequently most loss occurred in this class of plants. The reduction in yield is stated to arise chiefly from a reduction in the number of fruiting tillers and of kernels per spike. Discussing possible other factors influencing yield, the author points out that competition from weeds would probably cancel out any improved nutritional conditions afforded the healthy plants by the presence of diseased ones and at the same time exert a detrimental effect on diseased plants themselves, thus causing further reduction in yield. As in Manitoba the percentage of weedy fields is large, it is considered that the estimates of loss from common root rot given in this paper are not too high.

Stanton (T. R.) & Coffman (F. A.). **Grow disease-resistant Oats.**—*Farmers' Bull. U.S. Dep. Agric.* 1941, 13 pp., 8 figs., 1 diag., 1943.

A number of new disease-resistant oats varieties have been developed, tested, and distributed for growing in the north-central states by State Agricultural Experiment Stations in co-operation with the United States Department of Agriculture [*R.A.M.*, xxii, p. 299]. The new varieties, outstanding among which are Boone, Marion, Control, Tama, Vicland, Cedar, and Vikota, combine high resistance to rusts [*Puccinia coronata* and *P. graminis*] and smuts [*Ustilago kolleri* and *U. avenae*] with high productiveness and desirable grain characters.

In Wisconsin, during the 1941 season in which crown rust [*P. coronata*] was very destructive, the average farm yield of the new variety Vicland [ibid., xxi, p. 441] was 69 bush. per acre as compared with 41·5 bush. for the standard varieties; in 1942 Vicland gave yields of 120 bush. per acre.

In Iowa damage to the oats crop caused by the severe crown rust epidemics of 1938 and 1941 was exceedingly heavy. During these two years the new varieties Boone, Tama, and Marion gave 60 bush. per acre as against 32 bush. yielded by the old varieties Richland and Gopher; the same two groups of varieties yielded 71 and 65 bush., respectively, in the years 1939, 1940, and 1942, when there was little or no crown rust.

Stanton (T. R.) & Coffman (F. A.). **Disease-resistant and hardy Oats for the South.**—*Fmrs' Bull. U.S. Dep. Agric.* 1943, 10 pp., 3 figs., 1943.

Attacks by crown and stem rusts [*Puccinia coronata* and *P. graminis*] and smuts [*Ustilago kolleri* and *U. avenae*] and by winter-killing are stated to have been the limiting factors in winter oats production in the southern states. In recent years new crown rust- and smut-resistant varieties, namely De Soto, Lega, Lelina, Letoria, and Stanton, which are as winter-hardy as the common varieties, have been developed and distributed to growers [cf. preceding abstract]. All these varieties originated from a cross between Lee and Victoria, made at Arlington Farm, Virginia, in 1931. Letoria is the most hardy of the five, with Stanton ranking second.

New red oats varieties resistant to crown rust and smut are Fulgrain (Strain 4), Victorgrain, Fultex, Ranger, Rustler, Quincy 1 and 2 [*R.A.M.*, xxii, p. 383], and Camellia, all originating from crosses between either Victoria or Bond and some standard local variety.

It is considered imperative in the South to treat all winter oat seed with new improved ceresan or other standard fungicide for the control of the smuts, root rots, and seedling blights. The use of certified seed is strongly recommended.

Gallagher (P. H.) & Walsh (T.). **The influence of manganese on the growth of cereals.**—*Proc. R. Irish Acad.*, Sect. B, xlix, 11, pp. 187–200, 2 pl., 1943.

Wheat in the Dublin district was affected in 1942 by manganese deficiency manifested, as in the case of a similar trouble of oats [*R.A.M.*, xx, p. 458], by the formation of grey, elongated specks on the leaves, sometimes covering the entire surface and causing apical withering. In one of the diseased crops, consisting of the Atle and April Red varieties, the former suffered much heavier damage than the latter. In a test to determine the effect of 1 per cent. manganese sulphate on the health of the plants, the grain yields of four sprayed plots amounted to 1·90, 1·42, 2·17, and 1·25 kg., respectively, compared with 0·88, 0·58, 1·16, and 0·55 kg., respectively, for the untreated controls.

The first symptom of the shortage in barley is a localized paling of the leaf, which soon develops into a number of small, oblong, grey spots with brownish margins; these in turn gradually enlarge and coalesce to form streaks parallel to the veins. The lesions tend to concentrate near the leaf tip, which becomes shrivelled. Affected rye plants show reduced vigour coincident with the production of whitish spots on the leaves, some of which bend over in the manner typical of grey speck of oats. In addition to the oats varieties already tested for their reaction to manganese deficiency [loc. cit.], a number of others were included in a new series of pot experiments, in which Potato (Ardee) and *Avena strigosa* proved to be virtually immune, Glasnevin Success 10, Victory II, Ardri, Sonas Potato 7, and Star sustained moderate damage, while Glasnevin Sonas, Failte, *A. fatua*, *A. nuda*, Wexford Tawny, and Early Miller were subject to increasingly severe attack in the order named; Victory II-Argentine shows acute symptoms in the early part of the season, but later makes a good natural recovery.

The Desprez was the most susceptible of the winter wheats to manganese deficiency in the early stages of growth, followed by Pajbjerg, Yeoman-Ironmaster, Queen Wilhelmina, and Squarehead Master, in the order named, but after mid-June, the first-named variety made a better renewal of growth than the two following. Atle was the most sensitive of the spring wheats to an inadequate manganese supply, and Red Fife the least so, Diamant, Kolbin, Red Marvel, and April Red occupying intermediate positions in the order named.

Maya was the most noticeably affected barley variety, followed in descending order by Kenia, Spratt-Archer, July Six-Rowed, Binder, and Old Irish, but the

growth of this crop was not materially impaired by a shortage of manganese, and the application of the sulphate did not therefore exert any very significant influence on the final yield. Similar observations apply in the case of rye, of which only the ordinary Irish seed was available for trials.

As already indicated by the outcome of previous investigations [loc. cit.], none of the various soil treatments applied against manganese deficiency exerted a permanently curative effect. Oats grown on manganese-deficient soil showed a marked diminution in the manganese content of the grain, but no correlation was apparent between that and varietal susceptibility. The use of immune varieties furnishes the most practical method of control on soils deficient in manganese.

MacLachlan (J. D.). **Manganese deficiency in soils and crops II. The use of various compounds to control manganese deficiency in Oats.**—*Sci. Agric.*, xxiv, 2, pp. 86–94, 1 fig., 1943.

In further studies of manganese deficiency in soils and crops in Ontario [*R.A.M.*, xxi, p. 193] during 1942 very heavy soil applications of compounds containing manganese sulphate were required to correct the deficiency in Erban oats grown on land where oats normally exhibited severe deficiency symptoms. The addition of sulphur at the rate of 1,000 lb. per acre increased the yield materially and in one instance reduced the amount of manganese necessary by about two-thirds. In comparative spraying tests a single 2 per cent. spray of manganese sulphate or of tecmangam (a commercial fertilizer containing 67 per cent. manganese sulphate) with a spreader and sticker gave the highest yield, though not as high as heavy soil applications. The spray caused some leaf-burning. Dusting with manganese sulphate and tecmangam without a diluent gave rise to severe injury. Three manganese ores, applied to the soil at the rate of 250 lb. per acre or as foliage dust equivalent in manganese content to a 1 per cent. manganese sulphate spray, gave little or no response.

When soil applications of tecmangam at rates ranging from 68 to 619 lb. per acre were made on a large muck field where oats normally express mild to moderate symptoms of manganese deficiency, both the yield and manganese content of the powdered grass from the first cutting (made just prior to jointing) indicated a response directly proportional to the amount of the compound added; the checks showed at the time of cutting mild symptoms. At the second cutting, 17 days later, there were no symptoms of manganese deficiency on the checks; the manganese content of the powdered grass made after this cutting indicated a response to the treatment, but there was no definite correlation with regard to yield.

In an addendum it is stated that Erban oats sown in 1943 on the entire range of manganese-deficient as well as adjoining normal soil at the Ontario Agricultural College showed no response to the heavy soil applications of manganese sulphate, either with or without sulphur, of the previous year.

Johns (D. M.) & Brown (H. B.). **Effect of date of planting on Corn yields, insect infestation, and fungous diseases.**—*Bull. La agric. Exp. Sta.* 327, 28 pp., 8 figs., 1941. [Received December, 1943.]

From 1933 to 1937, inclusive, an experiment was conducted on Mississippi alluvial soil at Baton Rouge, Louisiana, to determine the effect of planting date on maize yields, insect infestation, and four diseases, namely brown spot (*Physoderma zeae-maydis*) [*P. zeae*], smut (*Ustilago zeae*), dry rot (*Diplodia zeae* and *D. macrospora*), and rust (*Puccinia sorghi*) [*P. maydis*] (yield data only were obtained in 1933).

The difference in yield was probably not significant in plantings made between 25th February and 15th May, but there was a consistent falling-off in those of June and July, which were mostly characterized by an increased rate of growth

and development. *Physoderma zeae* was most severe in the planting of 15th May (average infection 27·5 per cent.), the ranges for the five earlier and three later plantings being 17·7 to 22·3 and 1·9 to 8·9 per cent., respectively. *D. zeae* was little in evidence in the 25th February and 12th and 28th March plantings (4·1, 3·4, and 3·8 per cent., respectively), but rose to 6·3 per cent. for those of 12th and 28th April, while the figures for 15th May, 1st and 15th June, and 3rd July were 6·4, 14·1, 10·7, and 9·6 per cent., respectively. The early spring plantings were virtually free from rust (traces only until 28th April, when 1 per cent. was reached, followed by 2·9, 4·8, and 5·8 per cent. for 1st and 15th June and 3rd July, respectively). Rust is likewise of negligible importance in early and mid-season plantings, but may be responsible for heavy damage in later ones, reflected in a sharp decrease in yield (average of five years for 15th June and 3rd July 20·2 and 10 bush. per acre, respectively), compared with 50·9, 48·6, 47·7, 46, 45·8, 44·8, and 34·5 bush. per acre for the plantings of 28th March, 25th February, 12th March, 28th April, 12th April, 15th May, and 1st June, respectively.

Jones (D. B.), Fraps (G. S.), Thomas (B. H.), & Zeleny (I.). **The effect of storage of grains on their nutritive value.**—*Reprint Circ. Ser., Nat. Res. Coun., Wash.*, 116, 14 pp., 1943.

This report (the seventh of the Committee on Animal Nutrition of the National Research Council of the United States) contains the following item of phytopathological interest. Swine were fed with maize that had become mouldy during storage in steel bins [cf. *R.A.M.*, xxii, p. 444] at the University of Illinois and their development compared with that of another lot receiving sound food. The following conclusion is quoted from the mimeographed report by B. W. Fairbanks, H. H. Mitchell, and M. D. Farrar (Extension Service in Agriculture and Home Economics, 1940)—'From the feed eaten for the production of 100 pounds of gain, it may be calculated that 1 ton of this sample of moldy corn had a feed replacement value equal to 1,667 pounds of corn minus 152 pounds of protein supplement. If sound corn is worth 56 cents a bushel or $20.00 per ton and the protein supplement is worth $40.00 per ton, the value of moldy corn is $13.63 per ton. At present feed prices the moldy corn was worth 68 per cent. the value of sound corn. In this connection we must not lose sight of the fact that the rate of gain is lower with moldy corn, and this results in a later marketing date.'

Hopkins (J. C. F.). **More information about the enemy of Maize : Diplodia.**—Reprinted from *Vuka, 1943*,, September–October, 2 pp., 1943.

Infection of maize by *Diplodia* [*zeae*, *Gibberella zeae*, and other species] is general throughout Southern Rhodesia [cf. *R.A.M.*, viii, p. 485], and also widespread in Northern Rhodesia and present in Nyasaland. Most probably, the disease has been introduced to all maize-growing countries on seed.

The chief predisposing factor is rainfall, the periodicity of which is of great importance. If the wet weather ends (in Southern Rhodesia) in February or March, the fungi become unable to penetrate the cob, or if they do so, cannot set up any extensive rot. As infection is often found when the cobs are reaped, although the crop appeared clean when stooked, some growers believe that infection spreads from cob to cob in the stooks, whereas more probably it results from spores deposited throughout the crop. If the moisture content of the grain is considerable, extensive rotting may occur before harvest. Even if the grain is not decayed, the fungus appears able to grow down the core and infect the grain. If, however, the cobs are left on the stalks, without stooking, they dry out more rapidly, and infection is checked; in seasons of late rainfall, indeed, it is questionable whether stooking is advisable.

In cold, wet weather seedling blight becomes rife, and a poor stand results. Soil

infertility also favours infection. A combination of adverse soil and climatic conditions renders many plants susceptible, while infection is sometimes correlated with mineral deficiencies. Some affected plants appear to show potash deficiency, and it would seem that either the fungus renders them unable to absorb the mineral, or that it easily attacks plants so affected. The author and Rattray have ascertained that some strains of maize are much more susceptible to potash deficiency than others.

Control depends principally on rotation and keeping up soil fertility, destroying infected residue, and seed selection and disinfection. None of the various fungi which in Southern Rhodesia are associated with the disease can pass in a living condition through the digestive tract of cattle; manure from animals fed on maize is not a source of infection. On the other hand, these fungi can, to a certain extent, withstand composting up to two turns. The amount surviving in the main bulk of the compost would probably have a negligible effect, but a concentration of mouldy cores and grain in one heap might, when applied to maize lands, result in appreciable soil infection. Infected wastes should be destroyed.

The black coating on old mealie stalks left beside a piece of land was found to consist almost entirely of living *Diplodia* spores. In the same way, infected cobs left in the lands become covered with spores of different fungi, and are poisonous to cattle. When whole cobs are found to be diseased, they should always be destroyed.

Grodsinsky (L.). **La podredumbre seca de la espiga del Maíz.** [The dry rot of the Maize ear.]—*Publ. misc. Minist. Agric., B. Aires*, 112, 4 pp., 1 col. pl., 1942.

Of recent years maize crops in Argentina have sustained increasing damage from dry rot, associated with two fungi, *Diplodia zeae* and *Fusarium moniliforme* [*Gibberella fujikuroi*], which may occur singly or together. Pending the development of resistant varieties, control should be based on the destruction of diseased material at harvest time and the use of seed from healthy ears, which should be dusted before sowing with an approved fungicide.

Melchers (L. E.) & Lowe (A. E.). **The development of Sorghums resistant to Milo disease.**—*Tech. Bull. Kans. agric. Exp. Sta.* 55, 24 pp., 9 figs., 1 map, 1943.

Milo disease of sorghum, the preferred name for the disease formerly known under the names crown, shoot, and root rot of milo, or *Pythium* root rot, commonly attributed to *P. arrhenomanes* but now thought to be due to a complex of factors [*R.A.M.*, xxi, p. 523], was first reported in Kansas in 1926 and is now widely distributed in the western half of the State, as well as in Texas, where it is even more serious, Oklahoma, New Mexico, Colorado, and California.

The symptoms of the disease [which are briefly described] are liable to confusion with chinch bug [*Blissus leucopterus*], drought, or alkali injury. Milo, darso, and certain milo hybrids are susceptible, while all other sorghums and Sudan grass are resistant. In tests of the most widely grown sorghums 27 varieties of forage, 50 of grain, 3 of grass, and 6 of broomcorn are listed as resistant to the disease, and 11 of grain sorghum as susceptible. Early in the investigations it was found that resistant selections could be isolated from bulk seed of standard milo varieties. The resistance of field selections was determined in a greenhouse seedling test in infected soil, which was also used for selecting resistant strains from the standard susceptible varieties. In the latter case the tested selections were then grown in the field in comparison with the standard varieties from which they came, and their yield, type, and other agronomic characters evaluated. The fact that resistant lines occur in the field and may be readily isolated from all milo varieties and many milo hybrids is of great importance to sorghum production. It may be explained by the tendency to natural hybridization in the field, very common in

sorghums, or it may be due to recurring mutation giving rise to resistant lines; the full explanation of this genetic problem is as yet unknown.

Two milo disease-resistant varieties, Finney (a selection of Dwarf Yellow milo [ibid., xvi, p. 33]) and Westland (either a natural hybrid or a selection of Wheatland) have been distributed by the Kansas Agricultural Experiment Station. On fully irrigated land so heavily infested with milo disease that Dwarf Yellow milo and Wheatland were complete failures, Finney and Westland produced excellent yields (three-year averages of 59 and from 47·2 to 70·4 bush. per acre, respectively). In four-year trials on non-irrigated land fallowed one year before seeding, Dwarf Yellow milo and Finney produced almost identical yields, except that in 1941, when the milo disease was very severe, the yield of Finney was considerably larger; the yields of Westland were heavier than those of Wheatland in all years, but particularly so in 1941. Several other resistant lines of Yellow Dwarf milo and Wheatland have been isolated, and numerous resistant selections are available of Colby, Day, Beaver, Darso, Sooner, Pygmy, and Quadroon.

Finney and Westland have been approved for certification by the Kansas Crop Improvement Association. When these varieties are grown for certified seed, it is imperative to check their disease reaction in infested soil in the greenhouse during the early autumn, since the crop may have been grown in infested soil. Two rows from seed of a field for certification are therefore tested against two rows of a susceptible crop and certification depends on the results of this test. When a field is suspected of carrying milo disease, farmers are advised to send in a 5 lb. composite soil sample to be tested by the seedling test, as even a trace of infection can be detected by this method, thus indicating whether it will be necessary to grow a resistant variety or not.

Leukel (R. W.) & Martin (J. H.). **Seed rot and seedling blight of Sorghum.**—*Tech. Bull. U.S. Dep. Agric.* 839, 26 pp., 1943.

Seed-borne and soil-inhabiting fungi, combined with adverse environmental conditions, have been found to be largely responsible for poor germination and emergence of sorghum, an important war-emergency crop. The examination of 23 lots of seed from Oklahoma, Texas, and Virginia showed that the spores of *Alternaria* spp. predominated, followed by *Fusarium*, while *Penicillium*, *Aspergillus*, *Rhizopus*, and *Trichoderma* were also present in abundance, and *Sphacelotheca* and *Helminthosporium* occasionally. Virulent strains of *F. moniliforme* [*Gibberella fujikuroi*] and *P. oxalicum* were isolated from diseased seedlings grown in sterilized soils. *G. fujikuroi*, *P. oxalicum*, *R. tritici*, *R. nigricans* [*R. stolonifer*], and *A. niger* used as inoculum sometimes reduced emergence and caused subsequent seedling blight, especially at 15° and 20° C. *Alternaria* did not appear to be pathogenic, apart from blackening the seeds. In general, however, soil-inhabiting organisms, especially *Pythium* spp., caused heavier reductions of stand than did the seed-borne fungi, frequently attacking the young plumule and thus completely inhibiting emergence, or destroying the mesocotyl, seminal root, and subcrown rootlets before the crown roots developed. Species of *Fusarium* from the soil were much less injurious than *Pythium*, while the pathogenicity of *Penicillium*, *Rhizopus*, and *Aspergillus* varied with the amount of inoculum, the health of the seed, and the environmental conditions after planting.

Seed-coat injuries, which are very common in threshed sorghum, were found to promote the ready access of fungi to the endosperm, *G. fujikuroi* and *P. oxalicum* being exceptionally active in this respect. At 25° the emergence from sound seeds inoculated with these two fungi, *A. niger*, *A. flavus*, *F. culmorum*, *P. expansum*, and *Sclerotium bataticola* [*Macrophomina phaseoli*] ranged from 4·3 to 47·8 per cent. less than from comparable uninoculated seeds, the corresponding reduction for inoculated damaged seeds being from 8·3 to 69·4 per cent. At 20° the reduc-

tions for the inoculated lots ranged from 0 to 85 per cent. for the healthy and 59·5 to 100 for the injured seeds.

Dusting Spur feterita seed with copper carbonate [see next abstract] improved emergence in all the tests except one and reduced the percentage of subsequent seedling blight in the inoculated series in 12 out of 14 cases at 25° and in 10 out of 13 at 20°.

Leukel (R. W.). **Chemical seed treatments for the control of certain diseases of Sorghum.**—*Tech. Bull. U.S. Dep. Agric.* 849, 24 pp., 2 figs., 1943.

Trials have been in progress at the Arlington (Virginia) Experiment Farm since 1937 on the control of seed- and soil-borne diseases of sorghum by chemical seed treatments. In general, the application of fungicidal dusts resulted in a considerable improvement in emergence as compared with the controls, chiefly through the elimination of fungi already present in the soil (*Pythium* and *Fusarium* spp.). For instance, in 1937 the percentage of emergence of seed dusted with ceresan and sown in sterilized soil at 20° C. inoculated with *P.* spp. was 42 compared with 11 for the untreated, while barbak 111, merko, new improved semesan jr., ceresan, new improved ceresan, and cuprous oxide raised the emergence figures in soil inoculated with *F.* spp. from 21 to 96, 95, 87, 85, 80, and 80 per cent., respectively. As a rule, the absolute increase in emergence from treated seed reached a maximum at 20°, whereas the relative improvement was greatest at 15°, and least at 25°. Thus, in soil infested with *F. culmorum*, *Gibberella fujikuroi*, *Penicillium oxalicum*, *Rhizoctonia* [*Corticium*] *solani*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *Pythium de Baryanum*, and *P. arrhenomanes*, the average emergence percentages of feterita seed at 15°, 20°, and 25° were as follows: untreated 6·4, 22, and 51·6, respectively; new improved ceresan 25, 48·6, and 73, respectively; copper carbonate 20·9, 42·1, and 70, respectively; cuprous oxide 20, 44·1, and 71·1, respectively; and sulphur 4, 25·6, and 47, respectively.

Discrepancies in the results of treatment at the recommended and heavier rates of dust application are attributed to differences in the variety of sorghum used, temperature, moisture, and extent of soil infestation. In cold soils severely infested by virulent pathogens the use of dosages at least twice as heavy as the prescribed rate is advocated.

Failure to achieve satisfactory control of kernel smut (*Sphacelotheca sorghi* and *S. cruenta*) in 1937 and 1938 with dusts applied at the rates of 2 to 3 oz. per bush. may have been due to an insufficiency of fungicidal material to inactivate all the seed-borne spores under the apparently ideal conditions for the parasites prevailing during the emergence period. In 1939, 1940, and 1941, the experimental results were better. For example, in 1939 new improved ceresan (½ oz. per bush.), copper carbonate, basic copper sulphate, cuprous oxide and sulphur (all at excess rates) reduced the incidence of infection in Sharon kafir from 14·3, 18·1, and 15·3 per cent. for spore dosages of 1 in 100, 1 in 300, and 1 in 600, respectively, to nil, merko permitting a trace of infection at the 1 in 600 rate only. Infection in Scarborough broomcorn was similarly reduced to nil by all the chemicals except merko and in Leoti sorgo a similar result was obtained, except that merko gave complete control of the weakest spore dosage while permitting traces of infection in the other two.

Chlorine gas [*R.A.M.*, xix p. 75] and sodium hypochlorite and formaldehyde solutions effectively combated smut, but their use is not recommended on account of inconvenience of application, cost, or seed injury. In connexion with the last-named factor, the deleterious effects of new improved ceresan appear to depend more on variety and dosage than on length of storage after treatment. Thus, when Leoti seed was planted one month after treatment at ½, 1, and 1½ oz. per bush., emergence was reduced by 5·3, 26·7, and 30·7 per cent., respectively, and 11·7, 23·6, and 36·5 per cent., respectively, of the seedlings showed mercury injury.

In Sharon kafir, on the other hand, emergence was not decreased and only 1·1, 1·8, and 5 per cent. of the seedlings were damaged by the treatments. In two separate tests in Maryland and Kansas in 1941 spergon gave absolute control of smut (checks 55 in the former and 37 in the latter location) in feterita and kafir and greatly improved emergence without injury to the seed.

The presence of glumes on the seed was found to impair the thoroughness of smut control by the new volatile dusts.

Planting smutted seed in soils with moisture contents adjusted to 30, 50, and 70 per cent. of saturation resulted in 26·8, 81·6, and 5·6 per cent. infection, respectively.

Huelin (F. E.). **The handling and storage of Australian Oranges, Mandarins, and Grapefruit.**—*Bull. Coun. sci. industr. Res. Aust.* 154, 60 pp., 3 pl., 2 graphs, 1942. [Photo-lithographed.]

This is a comprehensive, fully tabulated survey and discussion of the results of investigations by the Citrus Preservation Technical Committee from 1935 to 1941 on various problems concerned with the Australian export trade in Washington Navel, Valencia, Joppa, Parramatta, and Siletta oranges, Emperor mandarins, and Marsh Seedless grapefruit, special attention having been paid to the two first-named orange varieties.

Of major importance among the agents of wastage are the green and blue moulds (*Penicillium digitatum* and *P. italicum*), the main avenue of infection by which under present conditions of export is wounding. This should be avoided by clipping the oranges from the trees and careful handling during sweating, processing, grading, and packing. Dipping in borax has proved effective against the moulds, but solutions above 1 per cent. tend to increase 'wilting'. Preliminary tests with shirlan, diphenyl wraps, and nitrogen trichloride ('Decca' gas) also gave promising but not yet fully conclusive results.

Stem-end rot (*Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri*) cannot be combated by any of the above-mentioned precautions, but require fungicidal treatment in the grove, and oranges infected at picking are almost certain to undergo extensive wasting during export, since the disease develops rapidly at atmospheric temperatures. At present, however, the bulk of the trade is confined to areas comparatively free from the agents of stem-end rot.

Besides the comparatively well-defined rind blemishes associated with *Phoma citricarpa*, *Septoria* spp., and an apparently functional disturbance known as 'glazed scab', consisting of dirty cream-coloured lesions with a hard, enamel-like surface, there remains a large group of imperfectly understood disorders, collectively termed 'storage spot' [*R.A.M.*, xx, p. 340], since most of the wastage from this source develops after a period of storage at 37° to 45° F. The contributors to the present report have been unable to draw sharp lines of demarcation between those types of spotting, which appear to include H. S. Fawcett's anthracnose spot, *Alternaria* spot, brown spot, and storage spot or pox [ibid., xv, p. 574]. On the other hand, it has been found helpful to separate the troubles into two classes, button and lateral spots, of which the former usually contain fungi, e.g., *A.* spp., *Colletotrichum gloeosporioides*, and *Fusarium* spp., while the latter are more frequently, though by no means invariably, sterile. Button spots are very prevalent and are apt to lead to subsequent rotting.

The interpretation of the data obtained in these investigations on storage spot presents some difficulty, since they appear to fit two entirely different conceptions of a complex disease, one functional and the other fungal. The fact that the incidence of the spotting generally declined with a rise in temperature from 40° to 55° is in keeping with a theory of cold injury, whereas its reduction by fungicidal treatments rather supports a hypothesis of microbial origin. In different lesions

the relative importance of the two factors may vary greatly, extreme cases being represented, on the one hand, by collapse and death of the rind tissue from purely functional causes, and on the other, by the fungal invasion of rind of naturally low resistance, inducing the formation of virtually identical spots: the latter form of the disorder has also been observed on non-stored fruit and that left hanging late on the tree. There are also many transitional types of storage spot, in which neither cold injury nor latent infection can be implicated as the sole agent, but an interaction of both factors probably takes place.

'Scald' is an extensive light brown, superficial discoloration developing at 34° to 37°. 'Gooseflesh', which is more prevalent at 32° to 34°, is characterized by pallor and depression of the tissue between the oil vesicles, often accompanied by an oily, disagreeable flavour and aroma: the affected areas are liable to rapid mould invasion on removal from storage. 'Skin bleach', which may assume a very serious form in cold-stored fruit, begins as a creamy, opaque discoloration of a considerable portion of the rind, the oil vesicles of which are darker than the surrounding tissue and stand out prominently. The affected area is somewhat soft and readily accessible to fungal invasion. The outer rind of mandarins suffering from 'crinkled collapse', a common cold-storage disorder, is pale, irregular, and crinkled, with dark, prominent oil glands. Finally, the skin darkens and the entire fruit collapses.

Since 1938 the Australian citrus export trade has been almost entirely restricted to New Zealand, and for this market the main consideration is the control of *Penicillium* rots by careful handling at all stages. Storage spot has hitherto been of negligible importance, and need not become troublesome if the oranges are 'sweated' (left loose in field boxes) for seven days after picking and not placed in cold storage until arrival at their destination. Non-refrigerated shipment is generally preferable, especially in the relatively cool Navel season. All 'sweat' boxes and every part of the processing and grading plant should be kept clean and smooth, while packing sheds should be regularly washed or sprayed with a fungicidal solution. To control 'wilting', oranges should be treated with a wax emulsion, to which not more than 1 per cent. borax may be added for mould elimination, as mentioned above. The 'hot fog' process, in which the fruit was sprayed with molten wax (90 per cent. paraffin, 10 per cent. carnauba) in a chamber heated to 150°, reduced the amount of wilting to about 45 per cent. of the control.

Speroni (H. A.). **Tizón gomoso de las ramitas de los Citrus.** [Gummy blight of Citrus shoots.]—*Publ. misc. Minist. Agric., B. Aires*, 114, 4 pp., 2 col. pl., 1942.

The form of gummosis described in this popular leaflet has been observed mainly in lemon groves in Argentina and is attributed to the agents of foot rot (*Phytophthora parasitica* and *P. citrophthora*) [*R.A.M.*, xxi, p. 195]. In September, 1938, the disease was found in the Paraná Delta to be affecting lemons grafted on trifoliate orange [*Poncirus trifoliata*] stocks, which are ordinarily resistant to this type of infection, but the insertion had been made unduly near soil-level (less than 10 cm. from the ground). The first symptoms of the trouble may pass almost unnoticed, consisting merely in a paling of the vivid green of the young shoots, followed by a slight swelling and exudation of a light amber-coloured gum: by this time the shoots have assumed a yellowish tinge, which finally turns a pale chestnut, imparting a scorched appearance to the affected parts. The fungi may, however, attack the fruits first, causing brown rot, and pass thence to the shoots, girdling and killing them under conditions favouring the pathogens, notably excessive atmospheric humidity and a moderate temperature (20° C.) without abrupt fluctuations. Control measures are indicated.

Sokoloff (V. P.) & Klotz (L. J.). **Decline and collapse of Citrus trees in relation to nitrite in orchard soils.**—*Calif. Citrogr.*, xxviii, 11, pp. 290, 308, 3 figs., 1943.

In continued studies on the decline and collapse of citrus trees [*R.A.M.*, xxii, p. 319] the association between failure of feeder roots and presence of nitrite in the root zone was further investigated. The addition of nitrite (equivalent to 40 p.p.m. nitrogen) to the soil caused the collapse of a vigorous Navel orange tree within a week. Root zones of collapsed lemon trees were frequently found to contain from 15 to 30 p.p.m. nitrogen as nitrite, and those of collapsed walnuts and apricots as much as 60 p.p.m. In the greenhouse similar concentrations of nitrite in water and in soil cultures proved toxic not only to citrus and avocado, but also to tomatoes, maize, peas, sugar and table beets, and other vegetables. Very small amounts of nitrite did not appear to cause appreciable injury to roots, but seemed to predispose them to infection by the brown rot fungi (*Phytophthora* spp.). In the absence of these fungi the roots usually recovered on removal to nitrite-free media. Grown in water cultures containing nitrite, sweet and sour orange, rough lemon, and a kumquat-mandarin hybrid were susceptible to the brown rot fungi, while grapefruit, shaddocks, and, under certain conditions, Sampson tangelo, were fairly resistant.

The nitrite is formed in soil from nitrate and organic matter in presence of excessive moisture, but not necessarily waterlogging. Accumulations of nitrite may also result from a delayed or inhibited oxidation of ammonia by bacterial action, in the normal process of which the ammonia is first oxidized to nitrite and then to nitrate. Small amounts of nitrate distributed in patches are capable of producing more nitrite than twice the same amounts spread evenly over the same area. In order to minimize the possibilities for the production of nitrite, it is recommended to withhold commercial nitrogen from the trees until the supply of soluble organic matter in the soil is at a minimum, especially during the periods of excessive moisture, and to distribute nitrogenous substances evenly and in small amounts several times a year so as to avoid local excesses as far as possible.

Cox (J. A.), Bobb (M. L.), & Hough (W. S.). **A fungous disease of the Comstock Mealybug.**—*J. econ. Ent.*, xxxvi, 4, pp. 580–583, 1 fig., 1 graph., 1943.

Following a rainy spell in August, 1940, a fungous disease destroyed from 40 to 50 per cent. of the Comstock mealybugs (*Pseudococcus comstocki*) in infested apple orchards in two localities of Virginia, and in the two succeeding summers it reappeared; by the autumn of 1942 the population of the insect in the two places visited by the pathogen had fallen to a very low level, presumably in consequence of the epidemic. [Vera K.] Charles and collaborators isolated the fungus in pure culture and concluded that it was a new species (abs. in *Phytopathology*, xxxi, p. 5, 1941), for which J. G. Harrar and J. J. McKelvey proposed the name of *Endosclerotium pseudococcia* [nomen nudum] (abs. in ibid., xxxii, p. 7, 1942). It has since been learnt, however, through correspondence with the Bureau of Plant Industry, Division of Mycology and Plant Disease, that the fungus under observation closely resembles the *Isaria* stage of *Cordyceps clavulata*, collected on the same insect on *Catalpa* trees in 1923 (*Tech. Bull. Va agric. Exp. Sta.* 29, 1925), but its exact identity of which is still in doubt.

Fitzgerald (L. R.). **Phoma stenobothri, a fungus parasite of the Grasshopper.**—*Amer. Midl. Nat.*, xxix, 3, pp. 761–767, 1 pl., 6 figs., 1943.

The presence of a fungus causing the death of grasshoppers (*Melanoplus differentialis*) was detected in the blood and muscles of specimens of the host from a colony maintained at the Zoology Department of the State University of Iowa in 1940. The pathogenicity of the organism, which produces no external changes in the grasshopper, even at the time of death, was established by artificial infection.

Histological examination showed that the only tissues to be attacked before death are the blood and muscles. The fungus cells [? spores] first appear in the haemolymph but are found in the haemocytes shortly after, and in the later stages of the disease all the haemocytes contain cells, often being so packed that the blood cell membrane is greatly stretched. The muscle fibres of infected animals become separated from each other, as do also the fibrillae, the striations disappear, and complete breakdown follows. The fungus forms in culture subspherical, subcarbonous pycnidia, 150 μ in diameter, and bluntly ovoid, hyaline, extremely refractive conidia, pinkish in the mass, 4 to 5 by 1·5 to 2·5 μ. The species is considered to be identical with *Isaria stenobothri* described by Hollande and Moreau (in *Arch. Zool. exp. gén.*, lxi, pp. 59–74, 1923), but in view of its characters is transferred to the genus *Phoma*, as *P. stenobothri* (Hollande & Moreau) comb. nov.

Varada Rajan (B. S.) & Patel (J. S.). **Stem-rot disease of Jute.**—*Indian J. agric. Sci.*, xiii, 2, pp. 148–156, 2 pl., 1943.

Stem rot of jute (*Macrophomina phaseoli*) is stated to be widespread in Bengal [*R.A.M.*, xx, p. 167], and to have been reported also from Assam and Bihar and Orissa. The sclerotial and pycnospore dimensions of the authors' collections were found to agree with those of Haigh (C strain) [ibid., ix, p. 685] and Ashby, respectively [ibid., vi, p. 757]. The pycnidial stage of *M. phaseoli* constitutes an important source of virulent secondary infection, the spores readily invading the leaves, the rot of which spreads through the petiole to the node. The incidence of secondary infection is generally four times that of primary (74·6 as against 18·6 per cent. in a field of 150 D 154 plants in 1941). Infection of the stem is followed by shredding, canker, or wilting. The primary root rot usually occurs sporadically late in the season, or earlier if high temperatures prevail. Late attacks are responsible for seed contamination, which is believed to be a more prolific source of primary infection than the soil. The fungus is also perpetuated on jute stubble and such crops as linseed, sesame, and cowpeas, while it is further harboured by the common weed, *Cyperus distans*. The critical period for the crop, and the most favourable for stem rot, is before the age of eight weeks or after that of 4½ months.

Carrera (C. J. M.). **La 'fusariosis' o marchitamiento del Lino en la República Argentina debida al 'Fusarium lini', Bolley.** [Flax 'fusariosis' or wilt in the Argentine Republic due to *Fusarium lini* Bolley.] —*Publ. misc. Minist. Agric., B. Aires*, 113, 4 pp., 1 col. pl., 1942.

The presence of flax wilt (*Fusarium lini*) was first established in Argentina in 1930, on the occasion of the visit of Professor H. L. Bolley of the University of North Dakota [*R.A.M.*, xi, p. 300]. The symptoms of the disease are briefly described and control measures recommended, the latter including the use of seed from the survivors of an epidemic, which may be credited with a high degree of resistance; a 7- to 11-year crop rotation; demarcation of foci of infection to avoid contamination of ploughs, harrows, and the like, which should be sterilized, if necessary, with a 2 to 3 per cent. formalin solution; burning of stubble, etc.; seed treatment with a mercury- or copper-containing fungicide or formalin (2 to 3 in 1,000); and shallow sowing at the earliest convenient date, while low temperatures still hold the development of the fungus in check.

Eichhorn (E.). **Beobachtungen an Farnrosten.** [Observations on Fern rusts.]—*Ber. bayer. bot. Ges.*, xxv, pp. 122–127, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 226, 1943.]

The distribution of 13 European fern rusts of the genera *Milesina*, *Hyalopsora*, and *Uredinopsis* is described. Species belonging to the two last-named genera cause a yellow discoloration of the fronds. *M.* spp. shun the light, especially *M. feurichii*

on *Asplenium germanicum* and *A. septentrionale*, which occur only in forest ravines.

Gigante (R.). **L''antracnosi' del Croton.** [Croton anthracnose.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, pp. 57–100, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 233, 1943.]

Croton (*Codiaeum*) shrubs were attacked in Italy in 1939 by anthracnose (*Glocosporium sorauerianum* Allesch.), which produced on the leaves circular or elliptical, brown spots with a reddish-brown halo, the petioles and median veins of the foliage being covered with oblong pustules surrounded by brown stripes. The centres of the spots on both leaf surfaces are occupied by numerous acervuli, from which arise hyaline conidia, 14 to 20 by 4 to 7 μ, borne on conidiophores 20 to 24 μ in length. The fungus grows readily on artificial media, especially those with an acid or neutral reaction, forming a profusion of conidia similar to those developing naturally on the host. The minimum, optimum, and maximum temperatures for the growth of the pathogen are 10°, 25°, and 40° C., respectively.

Ulbrich (E.). **Hexenbesen und Hexenbesen-Rost an Berberis vulgaris L. und über die Gattung Tuberculina Saccardo 1880.** [Witches' broom and witches' broom rust on *Berberis vulgaris* L. and the genus *Tuberculina* Saccardo 1880.]—*Notizbl. bot. Gart. Berl.*, xv, pp. 415–420, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 234, 1943.]

Besides the witches' broom produced on barberry by *Puccinia arrhenatheri* [*R.A.M.*, xx, p. 596], another form of the disorder exists attributable to mechanical friction of the branches. Numerous stations of the rust on barberry are listed. The aecidia of *P. arrhenatheri* are sometimes covered with the conspicuous pinkish-purple deposits of *Tuberculina persicina* [ibid., xix, p. 730], which was further observed on *Aecidium rhamni*. The taxonomy of the hyperparasite and its connexion with the rusts are discussed.

Drayton (F. L.) & Groves (J. W.). **A new Sclerotinia causing a destructive disease of bulbs and legumes.** *Mycologia*, xxxv, 5, pp. 517–528, 11 figs., 1943.

In 1931 a species of *Sclerotinia*, apparently identical with *S. minor* in culture, was isolated from completely rotted tulip bulbs, from Utica, New York, the sclerotia, up to 6 mm. in diameter, being densely packed beneath the tunic and between the scales. In 1935 apparently the same fungus was received from Edmonton, Alberta, where it had caused a destructive root rot of lucerne and sweet clover (*Melilotus* sp.); and from Westmount, Quebec, where it attacked tulips, 70 per cent. of the bulbs in one bed having either failed to grow or having produced only a few small leaves. Further isolates were received from rotted tulips from Montreal in 1936, from white and yellow sweet clover (*M. alba* and *M. officinalis*) from Edmonton in 1937, and from tulip and narcissus from another planting at Westmount in 1939.

Of 12 cultures studied apothecia were obtained from nine (four from tulips, one from narcissus, and four from sweet clover), and all the evidence indicated that the fungi obtained from the bulbs and from the legumes were identical. The fungus, which differed from *S. minor* in the darker colour of its apothecia, its smaller asci and ascospores, and the different conditions required for the production of apothecia, also differed from *S. intermedia*, which showed a more abundant aerial mycelium, fewer and fleshier sclerotia, and longer, narrower asci and ascospores. It is named *S. sativa* n.sp. The 8-spored, cylindrical asci have a slender, tapering stalk, and measure 100 to 120 to (130) by (7·5) to 8 to 10 μ; the ellipsoid to ovoid, hyaline, one-celled, uniseriate ascospores measure 9 to 11 to (12) by 4 to 5 to (7) μ.

Inoculation experiments at Edmonton showed that the isolate from the Utica

tulips was highly pathogenic on the roots of lucerne and sweet clover. Later, four further isolates from tulips were found to be strongly pathogenic to both lucerne and sweet clover. The Edmonton isolates from the legume hosts were consistently more pathogenic to sweet clover than to lucerne, while the tulip isolates from Utica attacked both hosts with equal severity. In a third trial the Utica tulip isolate and a sweet clover isolate were used to inoculate bulbs of six tulip varieties. The results showed that the Utica tulip isolate completely rotted all the bulbs of all the varieties, except one bulb of Prince of Austria, which was partially rotted, and from which weak growth had started. The sweet clover isolate produced similar symptoms to those of the tulip isolate, except that it gave more partially rotted bulbs. With both cultures the completely rotted bulbs were pulpy and had concentric rings of sclerotia packed between the scales. In the partially rotted bulbs most of the decay was at the base or between the outer scales and the growth of the shoot was much retarded. The evidence obtained also demonstrated that the fungus required the low temperatures of the soil experienced at Edmonton during late autumn, winter, and early spring for its pathogenic activity.

In efforts to obtain apothecia in November, 1938, tulip and legume isolates were transferred to wheat plates, and for two months half were incubated at 14° C. and half at 5°. Only individual sclerotia were used on the sand in the preparation dishes, and they were placed at 0° for a month, followed by two weeks at 5° after spermatization, then two weeks at 14°, after which they were transferred to the greenhouse. In June, 1939, the cultures were placed at 0°, and in November they were returned to the greenhouse. On 7th March, 1940, a mature apothecium was observed, and apothecia continued to develop until May.

To ascertain the sexual behaviour of the fungus eight single ascospore cultures from both tulip and legume isolates were grown on wheat at 5° and 14° for three months, and individual sclerotia were then put on moist sand at 0° for two months. One set remained unspermatized, two sets were spermatized with spermatia from single ascospore cultures from tulip isolates, and two were spermatized with spermatia from single ascospore cultures from sweet clover isolates. Apothecia appeared in both spermatized and unspermatized dishes, showing conclusively that the fungus was homothallic and self-fertile.

Smith (O. F.). **Rhizoctonia root canker of Alfalfa (Medicago sativa).**—*Phytopathology*, xxxiii, 11, pp. 1081–1085, 1 fig., 1943.

The fungus isolated from cankered lucerne roots in southern California and south-western Arizona was identified by J. E. Kotila as *Rhizoctonia* [*Corticium*] *solani*, the circular or oblong, sunken, sometimes brown-bordered lesions caused by which usually develop at the point of emergence of a young root from a larger one. The central region of the root may be partially involved in the decay, but there is very little spread of infection upwards or downwards from the site of entry. The pathogen is favoured by the high soil temperatures (21° to 35° C.) prevailing locally from June to September, its activity being suspended during the winter months at a range of 5° to 10°. Lesions formed during the summer usually heal over by mid-winter or early spring, when there is often only a scar on the root to mark the position of the previous season's attack. Under controlled conditions the disease assumed a severe form on roots grown at a soil temperature of 25° to 30°, but was practically absent from those maintained at 16° to 18°. Positive results were given by soil inoculation experiments with barley grain cultures of *C. solani* at the higher temperature range, and there is considered to be no doubt that the fungus is the cause of the root canker which contributes materially to the heavy losses incurred of recent years by growers in and near the Yuma Reclamation Project.

Scripture (P. N.) & McHargue (J. S.). **Effect of boron deficiency on the soluble nitrogen and carbohydrate content of Alfalfa.**—*J. Amer. Soc. Agron.*, xxxv, 11, pp. 988–992, 1943.

In a greenhouse at the Kentucky Agricultural Experiment Station Grimm lucerne was grown in purified sand cultures, boron being omitted from the synthetic nutrient solution in five of the ten pots after the seedlings reached 5 in. in height. Extracts of the plant tissue were obtained by Chibnall's method with the aid of a Carver press (*J. biol. Chem.*, lv, pp. 333–342, 1923) and analysed for nitrogenous constituents and reducing sugars. Soluble nitrogen compounds, including amides, ammonia, and nitrogen in other forms, were found to be present in higher proportions in the boron-deficient plants, with their slightly roughened and thickened yellow or yellow-bronze leaves, and suppressed terminal buds [*R.A.M.*, xxi, p. 494], than in those making normal growth. The affected plants also contained an excess of sugars. The possibility of a connexion between boron and the protein metabolism of plants is suggested on the basis of these observations.

Richter (H.). **Lupinenfusariosen.** [Lupin fusarioses.]—*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, 64, pp. 50–61, 1941. [Abs. in *Z. PflKrankh.*, liii, 4–7, p. 236, 1943.]

Yellow lupin (*Lupinus luteus*) wilt (*Fusarium oxysporum*) endangers the cultivation of the crop in infested areas in Germany [*R.A.M.*, xviii, p. 832], where the fungus is disseminated mainly by means of diseased plant refuse, as well as through the seed. In inoculation experiments the isolates from yellow lupin were pathogenic only to their own host. In some cases, however, the blue (*L. angustifolius*) and white (*L. albus*) lupins yielded wilt-inducing strains differing culturally from those attacking *L. luteus* and not always pathogenic to the last-named species in infection tests. The white lupin also suffers from a pod rot associated with a wound parasite, *F. avenaceum*, which was weakly parasitic on the other species in artificial inoculations.

Kreitlow (K. W.). **Ustilago striaeformis. II. Temperature as a factor influencing development of smutted plants of Poa pratensis L. and germination of fresh chlamydospores.**—*Phytopathology*, xxxiii, 11, pp. 1055–1063, 1 fig., 1943.

Poa pratensis plants infected by stripe smut (*Ustilago striaeformis*) [*R.A.M.*, xxiii, p. 21] were collected in 1941 and 1942 from some 75 pastures in Pennsylvania where high field and greenhouse temperatures were found to be unfavourable for their development. Some of the diseased plants lost the symptoms of infection after four months' continuous exposure to a temperature of 32° C., but regained them for the most part on transference to one of 20° to 25°. Chlamydospores removed from the leaves of diseased plants growing at 32° germinated to the extent of 90 per cent. without any after-ripening period, which was reduced, moreover, from 200 to under 30 days by the incubation of detached smutted leaves at 35° in a moist chamber. No germination took place, however, in the case of chlamydospores taken from plants growing at 1·5°, 10°, or 20° to 25°.

The examination of chlamydospores from over 300 smutted *P. pratensis* plants collected in 75 pastures failed to disclose the presence of physiologic races of *U. striaeformis* with germinable fresh spores.

Wernham (C. C.) & Kirby (R. S.). **Prevention of turf diseases under war conditions.**—*Greenk. Reptr*, xi, 4, pp. 14–15, 26–27, 1943.

In Pennsylvania the principal turf diseases on greens [*R.A.M.*, xxii, p. 436], in order of importance, are large brown patch [*Rhizoctonia* spp., chiefly *Corticium solani*], small brown patch or dollar spot [*Sclerotinia homoeocarpa*], 'melting-out'

(*Helminthosporium*) [and *Colletotrichum*] spp., and on fairways bluegrass [*Poa*] leaf spot [? *Septoria poae*], 'melting-out', and snow mould (*Typhula*). A key for the recognition of these disorders is given.

Large brown patch is partially controllable by preventive measures, including the sparing use of inorganic nitrogenous fertilizers, watering in the morning to insure rapid drying at a rising temperature, and judicious pruning of trees and shrubs to provide air drainage. Where mercury compounds are available, a mixture of calomel [mercurous chloride] and mercuric chloride (2 : 1) is effective at a dosage of 1½ to 3 oz. per 1,000 sq. ft., the lower rate being preferable during hot weather. The fungicide may be mixed with sand and broadcast, or applied with a power sprayer. If mercury compounds are unobtainable, hydrated lime should be broadcast at the rate of 10 lb. per 1,000 sq. ft. at three-weekly intervals, the green being poled immediately after treatment and not washed for 24 hours. Dollar spot may also be effectively combated by the above-mentioned mercury mixture, or by thiosan at the rate of 5 oz. per 1,000 sq. ft.; the latter may further be substituted for lime in areas where both large and small brown patch are present, or where the use of lime is undesirable. *S. homoeocarpa* does not yield to indirect measures of control, but those recommended against large brown patch are similarly effective in the reduction of 'melting-out', which may also be treated with thiosan or lime. The 2 : 1 mercury mixture (2 oz. per 1,000 sq. ft.) gave the best control of snow mould in two years' experiments, while promising results were also obtained in one season with spergon (6 oz. per 1,000 sq. ft.).

Bluegrass leaf spot falls into two stages, one involving the foliage and the other the crown. The spots on the leaves are straw-coloured, necrotic, ¼ to ½ in. long; when the crowns are attacked all the leaf blades may appear dead and severed, leaving only a reddish-brown tuft. The latter form of the disease is most destructive on closely clipped turf, and may be held in check by setting the mower to cut 1½ to 2 in. high during the spring, and by spring or autumn applications of a fertilizer to strengthen the grass.

Copper spot, first observed in the summer of 1942 at State College, is characterized by irregular, coalescent, copper-coloured areas on the grass, differing in hue from the bleached straw of the otherwise similar dollar spot. When the leaves are wet with dew, pink or reddish, gelatinous fungal pustules, the size of a pin's head, may be observed. Work on control measures is in progress.

Brief notes are given on the blemishes caused by slime mould [*Mucilago spongiosa*: ibid., xiv, p. 766] and fairy rings, the former removable by washing the turf with a stream of water from a hose, while treatment of the latter is impracticable.

HEARN (J. L.). **Rhizoctonia solani Kühn and the brown patch disease of grass.**—*Proc. Tex. Acad. Sci.*, xxvi, pp. 41–42, 1943.

The discoloured (alternating light and dark brown) patches in grass caused by *Rhizoctonia* [*Corticium*] *solani* [see preceding abstract] may attain a diameter of more than 20 ft. in Texas, where the disease usually develops between September and January. In this typical form of brown patch the roots and stolons sustain no injury, but a spring and summer manifestation of the disease is accompanied by the death of the roots, followed by that of the stolons and leaves. The fungus occurs in soils with a P_H ranging from 6 to 8·2, with an optimum at 7, and is favoured by temperatures between 72° and 94° F., as well as by an excess of nitrogen, especially in the form of ammonium sulphate. Effective fungicides for use against brown patch include semesan, uspulun, corona 620, corona 640, germisan, mercuric oxide, mercuric cyanide, and mercurous chloride, nitrate, and sulphate, a formula of 2 oz. mercurous chloride and 1 oz. mercuric chloride in 8 pts. dry sand per 1,000 sq. ft. being widely used [loc. cit.]. Tetramethylthiuram disulphide, incorporated in Du Bay 1205 FF, thiurad, and tuads, has given satis-

factory results at 4 oz. per 1,000 sq. ft., while Bordeaux mixture may be useful in alkaline soils.

DENNIS (R. W. G.). **A black rot of Apples, new to Britain.**—*Gdnrs' Chron.*, Ser. 3, cxiv, 2972, p. 221, 2 figs. (1 on p. 223), 1943.

The fungus isolated at the Plant Pathological Laboratory, Department of Agriculture for Scotland, in September, 1942, from the rotten tissues, with coal-black centres and brown edges, of four apples from a Corstorphine (Edinburgh) garden was identified by Dr. G. R. Bisby as *Strasseria carpophila* Bres. & Sacc., first described on the same host from Lower Austria (*Verh. zool. bot. Ges., Wien*, lii, pp. 429–437, 1902). The Scottish material agrees in the main with the original diagnosis, except for the slightly smaller pycnospores (9 to 14 by 2 to 3 as compared with 13 to 17 by 3 to 4 μ) and shorter appendages (mostly 13, occasionally up to 20 μ in length as against 18 to 24 by 0·5 μ). Von Höhnel (Fragmente zur Mykologie, Mitteilung xviii, 1916) drew attention to some typical features of the fructifications in the Austrian collection, which consisted of a whitish crust under the host epidermis overlying a ring of dark tissue, composed of thin-walled cells 4 to 6 μ in diameter and measuring 170 μ across, 100 μ in thickness at the margin, but only 25 μ at the centre, where it is replaced by a core of hyaline cells breaking down to form the ostiole. The mature pycnidia are multilocular. These characters were clearly marked in the Edinburgh specimens.

S. carpophila is likely to be more frequent on diseased apples than might be gathered from the paucity of records in the relevant literature, being no doubt commonly overlooked owing to the delayed maturation of the pycnidia (commencing on 10th October in the writer's material) and the difficulty of detecting the appendage on any but ripe, naturally exuded spores. An entirely blackened apple received from Ross-shire in October, 1940, bore immature fruit bodies also probably belonging to *S. carpophila*, the isolation of which was prevented, however, by bacterial contamination. Apples infected by this type of rot turn black before picking, and are thus readily distinguishable from those invaded by *Sclerotinia fructigena* during storage. No inoculation experiments were carried out with *Strasseria carpophila*, but in the Edinburgh collection, at any rate, it appears to have developed as a sequel to primary infection by *Botrytis cinerea*, which was readily isolated from the brown marginal tissue of the lesions.

MOTE (D. C.) & OWENS (C. E.). **Insect pests and diseases of Currants and Gooseberries.**—*Circ. Ore. agric. Exp. Sta.* 152, 11 pp., 4 figs., 1943.

The most troublesome diseases of currants and gooseberries in Oregon are powdery mildew (*Sphaerotheca mors-uvae*) and leaf spot (*Pseudopeziza ribis*), while damage is also sometimes caused by die-back (*Plowrightia ribesia* and *Botrytis* sp.), mushroom root rot (*Armillaria mellea*), and weakening or killing of the plants due to high water table and defective drainage. Spraying schedules are given for the control of the insects and fungi listed, separately and in combination. Lime-sulphur is effective against powdery mildew alone, but should be replaced by Bordeaux mixture for the later applications where leaf spot is also present.

Statutory rules and orders, 1943, No. 1686. Destructive Insect and Pest Acts, England. The Sale of Diseased Plants (Amendment) Order of 1943. Dated December 6, 1943.—2 pp., 1943.

The present Amendment, which came into operation on 15th December, 1943, to the Sale of Diseased Plants Order of 1927 and its Amendment of 1936 [*R.A.M.*, xv, p. 464], revokes the Onion Smut Order of 1921 and brings onion and leek smut (*Urocystis cepulae*) under the two above-mentioned Orders, thereby retaining the essential control measure, i.e., the prohibition of sale for propagation of any onion or leek plants substantially affected by the smut.